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VAYSSIÈRE (P.) & FEYTAUD (J.). **Le criquet migrateur dans la région bordelaise.** —*C. R. Acad. Agric. Fr.* **31** no. 9 pp. 460–461, 1 ref. Paris, 1945.

Locusta migratoria, L., has long been present in the solitary phase in southern France, especially the Gironde, but in 1945 it became very numerous and gregarious on the low plateau between the River Garonne and the Bassin d'Arcachon [*cf. R.A.E.*, A **34** 34]. Mass hatching began in April–May, but was not reported until 20th June, when large bands of locusts, many already with wings, were observed moving over the ground north-west of Las and in the commune of Cestas. These were the only foci discovered, but the former was probably more extensive than was then apparent. Both areas are hot and sandy and were drier than usual; the trees had been destroyed by fire and the vegetation was herbaceous. Wild grasses were largely defoliated by the locusts and fields of maize destroyed. Later, probably as a result of migration, four neighbouring communes became affected to a greater or less extent. On 25th June, many hoppers were still in the fifth instar, and the last ones became adults at the beginning of July. Flights were first seen on 13th July, and a further five communes became infested and suffered damage to varying degrees. On 20th July, a flight passed eastward over Bordeaux at a height of about 160 ft., and the flights continued until the end of July, reaching a maximum on 24th July, when locusts in phase *transiens* migrated from the two foci to the south-east and to the north as far as Carcans and Listrac, where they were still found in October. Some that moved backwards and forwards for several weeks were observed in a swarm near Las on 15th–18th September; the males were yellow and the females greyish in colour. Green or black locusts in the solitary phase were found in unusual abundance at a number of points in southern Gironde and northern Landes. Mating was observed everywhere from 15th August.

The outbreaks are attributed to exceptionally dry weather for four successive years, which caused many forest fires; as a result, the higher parts of the Gironde became almost desert-like and resembled the normal breeding centres of this locust. The outbreaks probably arose in these areas, but may have been initiated by locusts entering with the east winds in 1944.

JANNONE (G.). **Principali cause di natura animale riscontrate dannose all' agricoltura dell' Africa Orientale Italiana durante il 1939.** [The principal animal Pests of Agriculture observed in 1939 in Abyssinia, Somalia and Eritrea.]—*Agricoltura colon.* **34** nos. 5–7 pp. 177–185, 241–253, 287–298, 19 figs. Florence, 1940.

A list of over 100 plants and trees of economic importance in Abyssinia, Eritrea and Somalia, with their scientific, vernacular and Italian names, is followed by notes on some 70 insects and a few other pests, arranged systematically, that were observed attacking them in 1939. The information on the individual pests includes the localities where they were found, the plants they attacked, their habits and the damage they caused. Control measures are suggested in some cases.

JANNONE (G.). **Osservazioni e rilievi su un singolare attacco di *Epilachna* (*Chnootriba*) *similis* spp. *tellinii* Wse. (Coleoptera, Coccinellidae) alle colture di orzo e di frumento dell'Uollo Jeggiù (Scioa, A. O. I.).** [Observations and Notes on a remarkable Outbreak of *E. similis tellinii* on Barley and Wheat in Uollo Jeggiu (Shoa, Abyssinia).]—*Agricoltura colon.* **35** nos. 1–2 pp. 1–13, 63–73, 15 figs. Florence, 1941.

Epilachna similis, Thnb., subsp. *tellinii*, Weise, the adults, full-fed larva and pupa of which are described, damaged barley and wheat in 1940 on a plateau about 7,500 ft. above sea-level, near Dessie, in the district of Uollo Jeggiu,

Abyssinia. Field studies were made during the second week of May ; at that time, most of the insects were in the pupal stage, the main damage having been caused by the larvae during late March and April, but some larvae and adults were present. No pairing or oviposition was observed, from which the author concludes that the adults are not sexually mature when they emerge. Both larvae and adults fed on the leaves ; either surface was attacked, but in each case the veins and the opposite surface were not injured. They were active, crawling from leaf to leaf and also from plant to plant, and the adults flew readily. Pupation occurred on the leaves. The adults began to emerge in numbers on 9th May, and many were seen flying to less heavily infested fields two days later ; they only flew short distances and did not cross canals or ditches.

Near Dessie, there are usually two grain crops a year, one sown in February and one in July, and about two generations of *Epilachna* could develop on each, the adults sheltering in crevices or weeds between crops. In some districts a third crop is sown, allowing another generation to develop between October and January, or this generation could be completed on wild grasses. Most of the fields attacked in 1940 were sown on various dates in March, and the earliest sowings were the most severely infested, growth and ear-formation in some cases being almost completely arrested. Barley was heavily attacked and wheat much less so, though wheat was severely and barley only slightly damaged in central Shoa in 1939.

Suggested methods of control comprise the use of trap-crops, sown several days before the main crop, and collection of the larvae and adults by sweeping with nets. Sweeps should be made while the larvae are in the third or fourth instars, and again 14–20 days later to catch newly-emerged adults before oviposition begins. In a trial on 11th May, which was not a favourable date, 210 larvae and 640 adults were taken on barley in 50 sweeps of the net. So far as possible, all suitable shelter for the adults should be destroyed. Tests carried out on 10th May 1940, in which sprays of 0·5 and 0·7 per cent. sodium arsenite and 0·5 per cent. sodium fluosilicate were applied to barley suggested that good control could be obtained with the fluosilicate if two applications were made at a fortnight's interval, but that the arsenite is likely to scorch the plants.

Pupae taken in central Shoa in 1939 were parasitised by an unidentified Chalcidoid, but no parasites were reared from the material taken near Dessie in 1940.

VENTURI (F.). **Contributi alla conoscenza dell'entomofauna delle Graminacee. VI.** [Contributions to the Knowledge of the Insect Fauna of Graminaceae.]—*Redia* **26** pp. 27–70, 3 pls., 17 figs., many refs. Florence, 1940.

In this part of a series [*cf. R.A.E.*, A **27** 3], notes are given on the distribution, bionomics, food-plants and in some cases parasites of seven species observed by the author in 1937 and 1938 in Tuscany and the Marches. They are the Hesperiid, *Adopaea lineola*, Ochs., which fed on the leaves of wheat, the Cecidomyiid, *Haplodiplosis equestris*, Wagner, which caused galls on the stems, the Noctuid, *Apamea* (*Parastichtis*) *secalis*, L., which fed in the stalks and also attacked barley, *Agromyza niveipennis*, Zett., which mined the leaves of oats, another Agromyzid, *Liriomyza flaveola*, Fall., which mined those of oats and occasionally wheat, the Anthomyiid, *Atherigona quadripunctata*, Rossi, which cut the stems of sorghum, and the Tineid, *Elachista gangabella*, Zell., which mined the leaves of *Dactylis glomerata*. The parasites reared were *Bracon abscissor*, Nees, from larvae of *Apamea* ; an unidentified Scelionid from those of *Haplodiplosis* ; *Solenotus* sp. and *Derostenus* sp. from *Agromyza* ; the same species of *Solenotus*, *Eulophus* sp., *Closterocerus* sp., *Miscogaster* sp., and an unidentified Braconid from *Liriomyza* ; and *Trichogramma evanescens*, Westw., from eggs of *Atherigona*.

LUPO (V.). **L'andamento climatico, la mosca delle olive e sua migrazione.** [Climatic Conditions, the Olive Fly and its Migration.]—*Boll. Lab. Zool. Portici* **32** pp. 137–177, 13 refs. Portici, 1943.

The investigations on the relation between meteorological conditions and the prevalence of *Dacus oleae*, Gmel., in olive groves near Salerno, begun in 1931–35 [*R.A.E.*, A **25** 68], were continued in 1936–42. Records of temperature, rainfall, relative humidity, the numbers of *Dacus* captured in bait-pans, the percentages of fruits attacked and the percentage parasitism of *Dacus* in each season are shown in tables and discussed ; the conclusions drawn confirm those reached in the earlier work. During 1937–40, investigations were also made into the effects of altitude on the course of infestation, by comparing the results obtained from the coastal region, about 160 ft. above sea-level, Rodío, at 820 ft., and Mandia, at nearly 1,700 ft. The fruit develops later at the higher altitudes, and in 1937, the first oviposition punctures on the new crop were observed in the three regions on 3rd July and 7th and 24th August, respectively ; infestation was not heavy at the higher altitudes until October. In 1938 and 1939 there was no infestation in Rodío or Mandia, and in 1940 the outbreak took much the same course as in 1937, adults being taken in spring and again in October.

A study was also made of local migrations of *D. oleae*. Adults were rarely taken in the coastal region between about April–May and the second half of June or early July, when the olives reached a size suitable for oviposition and there was a sudden increase in the captures of flies. These individuals could not have recently emerged in the district, after such a prolonged absence of adults, and though it is not known whether any remain sheltering in wild or cultivated vegetation until olives are available, it appeared from a comparison of the catches made at different altitudes that there was migration to the coast from the mountains, where the flies develop on late olives, which remain on the trees through the winter, and on *Elaeagnus angustifolia*. The results indicated that the flies migrate to the coast in June–July from altitudes above 1,300 ft. and return to them in September–October, both movements being related to the availability of fruits and occurring on days when the weather is damp and overcast, with very little wind.

LUCCHESE (E.). **Contributi alla conoscenza dei Lepidotteri del melo.** [Some Contributions to the Knowledge of the Lepidopterous Pests of Apple.] **VI.** *Ancylis selenana* **Guen.**—*Boll. Lab. Zool. Portici* **32** pp. 178–196, 15 figs., 9 refs. Portici, 1943.

In this paper, the sixth of a series [*cf. R.A.E.*, A **35** 281], the author describes all stages of the Tortricid, *Ancylis selenana*, Gn., and reviews its geographical distribution and food-plants. In Campania, it chiefly attacks apple, to a less extent pear, and occasionally plum. In 1942, adults from overwintering larvae appeared between 10th April and mid-May, by which time pear trees were in leaf and the leaves of cultivated apple were starting to appear. They were active at dusk, and after pairing, the females laid their eggs singly on the leaves, usually on the upper surface. Females in the laboratory laid about 120 eggs in 10 days and survived for up to 14 days. The eggs hatched in 6–7 days in June–September, but required up to three days longer in May and in October. The newly-hatched larvae moved to the underside of the leaves and spun tubular webs close to a vein, beneath which they fed on the parenchyma ; as they grew, they enlarged their shelters by fastening together two contiguous leaves. Humidity within these shelters was high. Successive generations of *A. selenana*, and also of other Lepidoptera, frequently made use of the same shelters. Pear trees were seldom attacked by *A. selenana* in midsummer, as the foliage then becomes tough, but they were again infested in October and November, after rains. The pupal stage was passed in a cocoon, spun either inside the

original shelter or between two fresh leaves, and lasted 8–9 days in May and a little less in the hotter months. Each generation lasted about a month ; there were six in 1942, the larvae of the last overwintering in their webs among fallen leaves. The eggs were parasitised by *Trichogramma* sp. and the larvae by *Elasmus* sp., a Bethylid resembling *Perisierola* (*Parasierola*) *gallicola*, Kieff., an ectophagous species of *Pimpla* and an endophagous species of the same genus that attacked full-fed individuals spinning their cocoons and was the commonest of the parasites observed and accompanied by *Trichomma* sp. which was rare ; larvae of the Syrphid, *Xanthandrus comtus*, Harr. [*cf.* **35** 282] were predacious on the larvae.

The damage caused by *A. selenana* is reduced by the arsenical sprays directed against *Cydia pomonella*, L., and other pests, and by the natural enemies. Further control measures were not therefore necessary except in nurseries and plantations where spraying was not carried out ; for such cases, sprays of lead arsenate or nicotine are suggested, one application to be made in May, when infestation is first observed, and a second, if necessary, 20 days later. The collection of fallen leaves in autumn is recommended ; they should either be burned or kept in a container from which the moths cannot escape until all parasites have emerged from them.

BERAN (F.). **Der Kartoffelkäfer (Coloradokäfer)** (*Leptinotarsa decemlineata* **Say).** [The Potato Beetle (Colorado Beetle) (*L. decemlineata*).]—*Flugbl. Bundesanst. PflSch.* no. 1 [4] pp., 1 col. pl. Vienna, 1945.

It was found in 1945 that *Leptinotarsa decemlineata*, Say, had spread into western and north-western Austria ; in view of this, notes are given on the appearance of all stages of the beetle, its bionomics, distribution, and food-plants, the injury it causes to potato, and measures for its control.

ROSTRUP (S.). **Vort Landbrugs Skadedyr.** [Pests of our Field Crops.]—5th edn. revd. by P. Bovien & M. Thomsen. 9×6 ins., xv+400 pp., 236 figs., many refs. Copenhagen, E. Christensen, 1940. Price *Kr.* 18.

This is a revised and enlarged edition of a work on pests of agricultural crops in Denmark of which an earlier edition adapted to conditions in North Germany has already been noticed [*R.A.E.*, A **19** 439]. The original scope of the book has been restored, though a few insects that have ceased to be of importance in Denmark have been omitted and some that have recently become injurious there are included for the first time. A chapter has been added by P. Bovien in which he discusses methods of preventing infestation and of controlling it by mechanical and chemical means or by the use of natural enemies.

SCHNEIDER-ORELLI (O.). **Bienenweide und Schädlingsbekämpfung.** [Pest Control and Flowers visited by Bees.]—*Schweiz. Bienenztg* Beih. 9 pp. 423–429. Aarau, 1945.

It is pointed out in this lecture that, despite a few exceptions, the interests of bee-keepers in promoting a supply of flowers for bees and those of growers in controlling pests that reduce the yield of crops are fundamentally compatible, since, for example, fruit trees that are protected from infestation blossom more profusely than those that are weakened by pests. The planting of flowering hedges and shrubs near fields in the interests of bees also favours certain insect parasites of crop pests, though some bushes, such as *Euonymus* and *Viburnum*, which are winter food-plants of injurious Aphids, should be avoided. Ichneumonid parasites must feed on nectar to produce their full complement of eggs, and some that attack crop pests have alternative hosts that breed on shrubs, so that the presence of the latter may increase pest control. Adult

Syrphids similarly feed on pollen, and the presence of flowers thus increases the production of larvae, which are predacious on Aphids, and has been found of value near fields of sugar-beet in Switzerland.

Insecticides should not be applied to open flowers and are indeed seldom required during the flowering period, even on fruit trees, but injury to bees was observed in a potato field that was sprayed with an arsenical at a time when weeds in it (mustard) were in full bloom, and a similar danger exists in rape fields overgrown with *Prunella*. Sprays against *Meligethes aeneus*, F., on rape are most effective when applied shortly before the plants flower, and bee-keepers should be warned if treatment is postponed until flowering time ; the economic value of such late treatment is in any case doubtful. DDT has proved effective against this beetle [*cf. R.A.E.*, A **33** 36 ; **34** 7], but tests of its effect on bees have given inconsistent results, so that further investigations are desirable.

FENJVES (P.). **Beiträge zur Kenntnis der Blattlaus** *Myzus* (*Myzodes*) *persicae* **Sulz., Überträgerin der Blattrollkrankheit der Kartoffel.** [Contributions to the Knowledge of the Aphid, *M. persicae*, Vector of the Leaf-roll Disease of Potatoes.]—*Mitt. schweiz. ent. Ges.* **19** pt. 11 pp. 489–611, 28 figs., 6 pp. refs. Berne, 1945.

The author briefly discusses the nature of plant viruses and the characteristics of the more important of those that affect potato. In Switzerland, the latter are estimated to cause an annual loss of 7·5–10 per cent. of the potato crop. Of those that are transmitted by insects, the most important in that country is leaf-roll (*Corium solani* of Holmes), of which the principal vector is *Myzus persicae*, Sulz. ; *M. circumflexus*, Buckt., also transmits it, but is rare there. The mechanism of transmission of viruses by Aphids is described, the synonymy, geographical range and morphology of the various stages of *M. persicae* are reviewed, and a detailed account is given of observations in Switzerland in 1941–43 on the bionomics and control of this Aphid.

The following is based on the author's summary. *M. persicae* was found in all districts in which potatoes are grown and up to altitudes of about 6,500 feet. In the region of Zurich, holocyclic winter development occurred on peach, apricot and nectarine ; gynoparae and oviparae were found in autumn on various other rosaceous plants, but no oviposition was observed. Peach was preferred to apricot and nectarine, and standard trees were more heavily infested than espaliers on walls. In all three years, the first gynoparae appeared in September, and the males somewhat later and in much smaller numbers. The oviparae developed in some 15–20 days, paired with the males and laid 5–10 eggs each. The total number of eggs laid was often small, owing to the disproportion between the sexes and the action of predators, especially Syrphids. The first fundatrices hatched in the first half of April, and gave rise to three apterous generations before any migrants were produced. Oviposition, hibernation and the development of fundatrices were also observed on rose near Airolo, at an altitude of about 4,000 ft. Anholocyclic winter development also occurred [*cf. R.A.E.*, A **30** 545] and was more important in eastern Switzerland than the holocyclic form. The Aphids survived in cellars, storerooms and greenhouses, but were usually killed in the open by January cold. Control should be effected by winter treatment of peach and apricot trees and by rigorous inspection of places suitable for anholocyclic winter development.

Since only the summer forms are of importance in the transmission of virus disease, surveys of the populations of *M. persicae* were carried out in the summers of 1941 and 1942 in potato fields in various districts and at various altitudes. It was found that the spread of disease depended on the intensity of infestation by *M. persicae* attained by 15th August, the number of generations a year, the density and seasonal occurrence of alatae, and the extent of migration and flight. Populations were affected by weather and natural enemies, chiefly

Coccinellids. By applying Davies' method of determining the index of infestation [*cf.* **22** 386], it was found that the localities least affected by disease and therefore most suitable for the selection of seed were those in which infestation by *M. persicae* did not exceed 20–30 individuals per 100 leaves or 15 per plant by 15th August ; localities where infestation reached 30–90 individuals per 100 leaves or 20–55 per plant by that date were suitable as propagation centres, while higher indices rendered a locality unsuitable for seed-potato cultivation.

It was calculated from laboratory rearing experiments that the threshold of development and thermal constant [*cf.* **23** 296] for summer forms of *M. persicae* are 4·3°C. [39·74°F.] and 137 day-degrees C. [246·6 day-degrees F.], respectively. With a rise in temperature from 9·9 to 25°C. [49·82 to 77°F.], the average duration of development fell from 24·5 to 8 days, the duration of life from 69 to 21 days, and the gestation period from 4·5 to 0·8 days, while the number of young produced per day rose from 1·1 to 3·3 [*cf.* **15** 259]. Development was probably shortest at about 24°C. [75·2°F.], and temperatures above 28°C. [82·4°F.] were harmful.

The influence of weather on flight was studied, mostly by means of a revolving trap [**24** 112] ; it was found that flight occurred freely at wind velocities of up to 11·2 miles per hour, but was restricted by higher velocities. The Aphids flew from the potato plants when the wind velocity did not exceed 6·7–8·9 m.p.h., and 40 in. above ground level the direction of flight was influenced by wind velocities above 6·7 m.p.h. Flight was checked by relative humidities below 40 per cent. in conjunction with temperatures above 26°C. [78·8°F.] and also by temperatures below 15°C. [59°F.]. It is concluded that windy situations where the average daily temperature does not exceed 15°C. are preferable to sheltered ones for the successful production of seed potatoes, and small, isolated plots to large areas. They should not be on slopes exposed to the prevailing winds.

Experiments on control of *M. persicae* were carried out with proprietary preparations of nicotine and Gesarol [which contains DDT]. A nicotine spray caused a rapid knockdown and 99·2 per cent. mortality of the Aphids on tulip in the laboratory, whereas 4–12 hours after spraying with Gesarol and a spreader, 50–75 per cent. of the Aphids were moving about over the plants, apparently unaffected. After 12 hours, 50 per cent. of these Aphids, or 30 per cent. of the total, moved with difficulty, and after 24 hours 50 per cent. of the total were dead or severely affected, while 15 per cent. appeared normal. After 48 hours, 75–80 per cent. were dead or severely affected, about 10 per cent. showed slight paralysis, and about 10 per cent. were still feeding ; a few individuals migrated from the plants after 5–6 days, and the remainder behaved normally and reproduced. In further experiments, winged and apterous Aphids placed in petri dishes that had been sprayed with Gesarol showed no reaction in 48 hours.

In limited field experiments with sprays and dusts, nicotine proved less effective, and Gesarol more so, than in the laboratory ; in both cases, the sprays were at first superior to the dusts, but it was observed after a few days that reproduction was slower on the dusted than on the sprayed plants. When the treated plants were not isolated from untreated ones, winged Aphids migrated to them ; they reproduced on plants sprayed with nicotine, but left plants sprayed a few days previously with Gesarol without reproducing. When three such individuals were caught and transferred to petri dishes containing untreated potato leaves, they at once began to feed and reproduce. Gesarol dust still showed repellent action after six days.

Field experiments were carried out in various localities in 1941 and 1942 to determine whether the spread of virus disease could be controlled by applying sprays and dusts of nicotine or Gesarol against *M. persicae*. It was found that whereas nicotine gave better direct control of the Aphids, Gesarol acted as a deterrent against migration to the plants by alates. In heavily infested areas,

three applications of a nicotine spray did not reduce the spread of infection in 1941, and eight applications of nicotine sprays or four of Gesarol gave inadequate results in 1942. In less heavily infested localities suitable for selection or propagation of seed potatoes, infection was reduced to some extent, and in one locality by nearly 50 per cent., by sprays and dusts of Gesarol.

The author concludes that some improvement in the quality of seed potatoes in moderately or lightly infested areas may be obtained by treatment with either of these insecticides, but that they can only supplement, and not replace, cultural control measures.

CLAUSEN (R.). **Observations sur la phalène anguleuse** *Chloroclystis rectangulata* **L.** —*Mitt. schweiz. ent. Ges.* **19** pt. 11 pp. 611–626, 8 figs., 30 refs. Berne, 1945.

Observations were carried out in 1940–44 in the laboratory and in orchards in the Rhône Valley on the bionomics of *Chloroclystis rectangulata*, L., which is injurious to the blossoms of apple and pear in Switzerland [*cf. R.A.E.*, A **33** 125 ; **35** 70]. All stages of this Geometrid are described, together with characters distinguishing the larvae from those of *Operophtera brumata*, L. The winter is passed in the egg stage, and the first larvae were observed in the open on 26th–28th March. Newly hatched larvae kept in the laboratory at temperatures between 12 and 20°C. [53·6 and 68°F.] with leaves and blossoms of apple or pear became full-fed in 19–25 days, those reared on pear developing a little more rapidly than those on apple ; all showed a marked and consistent preference for the anthers. In the orchard, the larval stage lasted 25–30 days, and larvae that had fed on pear blossom were always the first to descend to the soil. No larvae were found on quince, plum, apricot or cherry, and those reared on these plants developed with difficulty and died in large numbers. The larvae pupated in cocoons on or just below the surface of the soil ; the pupal stage lasted 18–24 days in the laboratory. The moths were present in the orchards from about the end of May until late June or early July. The eggs were laid in lots of 1–11 in sheltered positions on the trunks and branches, and particularly on small branches, ½–1½ ins. in diameter. Females kept in sleeves laid an average of 47 eggs each, but more than 100 are probably laid in nature. Larvae could be discerned within the eggs 13 days after oviposition ; they entered into diapause and hatched in the spring.

No parasites were reared from *C. rectangulata*, in spite of repeated attempts, but various mites were observed within empty eggshells, where they may have been merely sheltering. The ants, *Tetramorium caespitum*, L., and *Formica fusca*, L., were seen carrying away adults that had fallen to the ground.

ZINKERNAGEL (R.) & GASSER (R.). **Über Getreidekonservierung. 1. Mitteilung : Biologische Grundlagen der Getreidekonservierung.** [Concerning Grain Preservation. First Contribution : Biological Principles of Grain Preservation.]—*Mitt. schweiz. ent. Ges.* **19** pt. 11 pp. 626–645, 5 graphs, 20 refs. Berne, 1945.

This is a discussion based on the literature and the authors' own observations in Switzerland of factors that are associated with the deterioration of stored grain, those considered being moisture, the development of moulds, heating, the production of carbon dioxide and infestation by insects. It is usually considered that the heating of stored grain is caused by insects, and an attempt has been made to estimate the heat production under known conditions [*R.A.E.*, A **32** 309], but it is still not clear how the process is initiated. The authors' investigations have shown that increase in temperature of the grain and infestation by insects proceed together ; heavy infestation was never observed in the absence of heating, but heating repeatedly occurred in the

absence of insects and appeared to be associated with high relative humidity and the development of moulds. Control of moulds, however, did not reduce heating once the process had begun. It has been suggested that heating and the production of carbon dioxide are natural results of the breaking-down of the grain, and further that the respiration of the grain is responsible for heating. Heating has also been shown to result from the absorption of moisture. The authors' investigations have shown that heating is caused by certain bacteria, as occurs in stacked hay. It thus appears that though insects possibly initiate the process, its continuance is due to other factors, and that heavy infestation by insects is the result rather than the cause of the phenomenon. The total amounts of heat produced are too great for insects alone to be responsible [but *cf.* **35** 192].

The production of carbon dioxide has usually been attributed to the respiration of the grain, but it was associated by Howe & Oxley [**32** 243] with infestation by insects. Their attempt to measure infestation by carbon-dioxide production is considered unconvincing, since the latter is largely dependent on moisture and temperature, and the temperature varies throughout a mass of grain. Oxley & Johns (1944) found that the production of carbon dioxide was not due to respiration of the grain and did not occur to any extent in wheat from which the epidermis was removed. They attributed it to the presence of a fungus found beneath the epidermis, but it is not clear whether this has modified Oxley's view of the relation between carbon dioxide and insect infestation.

Insects are the most important of the animal pests of stored grain, and a list is given of the species concerned. The loss caused usually amounts to about 5 per cent., but reaches 50 per cent. under abnormal storage conditions. A DDT dust (Geigy 33) has been developed in Switzerland for use against them. Stored grain is rich in nutritive material but has a low water content, so that the water balance of insects developing in it is necessarily very finely regulated, and this is confirmed by the action on them of inert dusts, which upset the water balance [*cf.* **33** 188]. The water contents of various stages of *Calandra granaria*, L., *Tenebrio molitor*, L., and *Ephestia kuehniella*, Zell., and of the cereals on which they developed are shown in a table. According to B. Thomas (1941), grain with less than 10 per cent. moisture content is immune from attack by *C. granaria*, and serious infestation develops only when the moisture content exceeds 14 per cent. [*cf.* also **30** 279, etc.]. At 17°C. [62·6°F.], *C. granaria* develops in 60–80 days, as compared with 24–29 days at 27°C. [80·6°F.]. Corresponding differences have been recorded for other grain pests, except that *C. oryzae*, L., develops more slowly than *C. granaria* at the above temperatures, since its optimum temperature is higher. A temperature of 35°C. [95°F.] is injurious to grain insects, and none survives for any length of time at 38–40°C. [100·4–104°F.] although a temperature of more than 45°C. [113°F.] is necessary for their rapid destruction. The fact that adult beetles emerge in winter in heated grain, which is a biologically abnormal time, is evidence that the acceleration of development is the result and not the cause of heating.

GÜNTHART (E.). **Über die insektizide Wirkung eines Benzolhexachlorid-Präparates.** [The Insecticidal Action of a Benzene Hexachloride Preparation.]—*Mitt. schweiz. ent. Ges.* **19** pt. 11 pp. 647–648, 7 refs. Berne, 1945.

The author very briefly reviews the literature on the insecticidal properties of benzene hexachloride [*cf. R.A.E.* A **33** 256, 331], and states that laboratory and field tests with a proprietary preparation of this material carried out in Switzerland since the spring of 1944 showed it to have very good and rapid contact action, although the residues from sprays and dusts did not retain their effectiveness so long as those of DDT. It also had a considerable power of

penetration, killing insects in certain stages of development within the tissues of plants. Dusts or sprays of this material were very effective against the weevils, *Ceuthorrhynchus pleurostigma*, Marsh., and *C. quadridens*, Panz.; a single application killed all the adults on cabbage plants in seed-beds and in the field, and also the eggs and young larvae in the midribs of the leaves, in the leaf-stalks, in the cortex of the stem or in small galls on the root collar, though some larvae in the pith of the stem and some larger larvae in galls survived. Repeated applications did not injure the plants.

[Nikolova (V.).] **Николова (В.). Cabbage Moth—*Mamestra* (*Barathra*) *brassicae* L. as a Cabbage Pest in Bulgaria and its Control.** [*In Bulgarian.*]—*Agric. Sci.* I. Plant Industr. **1** no. 1 pp. 123–156, 10 figs., 44 refs. Sofia, 1945. (With Summaries in Russian and English.)

The biology, food-plants and distribution of *Mamestra brassicae*, L., are reviewed from the literature, all stages are described, and an account is given of observations in 1941–44 on its bionomics in Bulgaria, where it is particularly injurious to cabbage, destroying an average of 20–30 per cent. of the crop each year, and also attacks many other cultivated plants, including lettuce, peas, beet, flax, sunflower, tobacco and egg-plant [*Solanum melongena*], as well as various weeds. Emergence of adults from overwintered pupae began in early April, was at its height during late May and June and continued for most of the season, and emergence of first-generation adults began in late June and reached a peak in late July. The moths usually paired two or three days after they emerged, and the females oviposited for 3–7 days, laying their eggs in batches on the leaves, petioles, and stems of cabbages and, to a less extent, on other plants. Under laboratory conditions, they laid 6–28 batches of 15–188 eggs, the total number of eggs ranging from 438 to 2,725. Females survived for 9–27 days and males for 8–25 when fed on sugar water, but unfed adults lived for only 5–6 days. The egg and larval stages lasted 6–9 and 25–30 days, respectively, in the field and rather less in the laboratory, and the pupal stage in the laboratory lasted 13–36 days in summer and 176–482 days for overwintering pupae. Pupation occurred in the soil, usually at a depth of 2 in. In a study of the developmental cycle, observations were made on the progeny of two pairs of moths of the overwintered generation that emerged in late May and late June 1943. The pair that emerged in May gave rise to two generations and a partial third. Some pupae of the second and all those of the third overwintered, but the adults from the former emerged earlier and over a shorter period in the following year than did those from the latter. The pair that emerged in June gave rise to two generations, of which the pupae of the second hibernated; most gave rise to adults in the following year, but some not until January 1945. Thus, the generations overlap and all stages are present in the field simultaneously.

Though large numbers of the larvae and pupae are destroyed by birds, this does not afford much control. The only parasites reared were *Tachina rustica*, Mg., from the larvae, *Elachertus lateralis*, Spin., from the pupae, and *Trichogramma evanescens*, Westw., from the eggs. In the field, parasitised eggs of *M. brassicae* were observed in August and September; of the eggs collected on cabbage in two localities in 1942, 40 and 60 per cent. were parasitised, as were all those taken in Sofia in September 1945.

The recommended control measures are deep ploughing to destroy the hibernating pupae, hoeing between the rows of cabbages to expose the summer ones, the destruction of weeds, repeated hand-collection of the larvae, and crushing of the eggs, with the exception of parasitised ones, which are easily distinguished by their purple-black colour. In tests of various insecticides, mostly proprietary products of unstated composition, in which larvae were placed on dusted or sprayed cabbage leaves standing in water, several dusts were effective, and

Gesarol, which contains DDT, was outstanding, giving complete mortality in 3–4 days. In a field test, a single application protected 79 per cent. of the cabbages in the dusted plot from infestation for 12 days, whereas only 17·5 per cent. were uninjured in the control plot. Spraying with 1 per cent. Gesarol in water with the addition of 2 per cent. tar soap as spreading agent gave promising results.

VUKASOVIĆ (P.). **Contribution à l'étude de l'hibernation de la pyrale du maïs.** [*In Serbian.*]—*Arh. poljoprivr. Nauke Tehn.* **1** no. 1 pp. 11–17, 2 refs. Belgrade, 1946. (With a Summary in French.)

Since the larvae of *Pyrausta nubilalis*, Hb., overwinter chiefly in maize stalks [*cf. R.A.E.*, A **25** 261], investigations were carried out at three places in Jugoslavia in the winter of 1940–41 to determine the distribution of the hibernating larvae in them and the height at which the maize should be cut at harvest. At one place, the stalks of some 180 infested plants were sorted into six groups according to the number of internodes, the part bearing the tassel being reckoned as the last internode. Stalks with fewer than nine and more than 14 internodes were rare and were discarded. The stalks were cut into sections and examined for larvae ; the results are given in a table showing the number of stalks in each group, the total numbers of larvae in them, and the percentages present in individual internodes. In stalks of all groups, 78 per cent. of the larvae occurred between the third and ninth internodes, inclusive, and 50 per cent. between the fourth and seventh. Less than 2 per cent. occurred in the first internode.

In the second locality, no larvae were found in the main root or the part between it and the adventitious root in the 100 plants examined, and the numbers found in the first and second internodes represented only 1 and 3 per cent., respectively, of the total. In the third, a district in Dalmatia, where it is customary to cut the maize high, the distribution of larvae in the first six internodes was studied ; 0·8 per cent. occurred in the main root and 2·4 per cent. in the first internode, as compared with 25·6 and 24·8 per cent. in the fourth and fifth internodes, respectively.

It is concluded that though the numbers of larvae hibernating in the lowest parts of the plants represent a much smaller percentage of the population than is generally supposed, there may be enough of them to be of importance in view of the high fertility of the moths. Maize should therefore be cut close to the ground, immediately above the adventitious root, or even below it in cases of severe infestation, when digging out and burning the root is also recommended.

The examination of the infested stalks revealed a number of places that had been more or less damaged by the larvae and then abandoned. Such damage occurred most frequently in the lowest internode, which indicates that a larva that attacks this internode tends to leave it. Only 3·35 per cent, of all the larvae found were parasitised, and parasitised individuals were commonest in or just above the seventh internode.

[VUKASOVIĆ (P.).] **Вукасовић (П.). Contribution à l'étude du régime de *Calandra granaria* L.** [*In Serbian.*]—*Arh. poljoprivr. Nauke Tehn.* **1** no. 1 pp. 62–65, 2 refs. Belgrade, 1946. (With a Summary in French.)

Experiments with *Calandra granaria*, L., were carried out in Jugoslavia to study the extent to which a polyphagous insect can become adapted to, and even develop a preference for, a particular food after having been reared on it for many generations. Beginning with adults taken from wheat, pure lines were reared for several years on various foods, of which barley, maize, and especially rye and wheat (*Triticum turgidum*) proved suitable, whereas oats, rice

and farinaceous products were not and had to be abandoned. Some of the material was destroyed at the beginning of 1941, but in August of that year experiments on a small scale were carried out in which batches of weevils of lines reared on wheat, rye or barley for 53–54 generations, were enclosed separately for 25 days with a mixture of equal parts of wheat, rye, barley and maize. They were then removed, and the four cereals were separated and a record made of the young weevils that emerged from each. Of the total, the percentages that emerged from rye, wheat, barley and maize averaged 46·2, 31, 11 and 10·7, respectively. Of adults of the wheat and barley strains, 28·6 and 27·4 per cent. emerged from wheat and 41·35 and 48·9 per cent. from rye. *C. granaria* seldom comes into contact with rye in Jugoslavia, since it is wheat that is extensively cultivated, but it appears from the experiments that it might become a serious pest of rye under favourable conditions.

Tolunay (M.). **Eine neue wirksame Anwendungsmethode des Globols (Dichlorbenzol) gegen Insekten und Kleintiere.** [A new and effective Method of using Globol (Dichlorbenzene) against Insects and small Mammals.]—*Zbl. ges. Forstw.* **68** pt. 4 pp. 91–92, 1 fig. Vienna [1942].

When Globol ([para]dichlorbenzene) was vaporised in 8–10 times its volume of boiling water over a small stove in a fumigation chamber at a rate of 1 oz. per 100 cu. ft. in experiments in Turkey, it gave about 90 per cent. mortality of *Calandra granaria*, L., ants, cockroaches and bed-bugs within 12 hours; the surviving insects were removed from the chamber, and all died within a further 12 hours. Higher concentrations gave more rapid mortality. In a test in which laboratory animals were similarly exposed to 2·5 oz. Globol, all showed distress for an hour and then died. It is concluded that Globol vaporised in this way at a rate of 1 oz. per 100 cu. ft. will kill all the insects and small mammals in a closed room in 12 or at most 24 hours. Naphthalene can also be used in this manner, but requires almost 20 times the quantity of water.

Aburto V. (H.). **El control biológico de los insectos mediante el uso de predatores.** [Biological Control of Insects by Means of Predators.]—*Fitófilo* **1** no. 4 pp. 3–11, 8 figs., 4 refs. San Jacinto, D.F., Mex., 1942.

The author reviews from the literature the factors that influence the degree of control of insect pests likely to be afforded by parasites and predators in a given environment, and gives a list of pests of crops in Mexico showing the parasites or predators that are, or might be, used to control them. Species that have recently been released there for that purpose include *Eretmocerus serius*, Silv., against *Aleurocanthus woglumi*, Ashby, on *Citrus* [*R.A.E.*, A **35** 77] and *Cryptolaemus montrouzieri*, Muls., against *Pseudococcus citri*, Risso, on *Citrus* and other fruits [*cf.* **31** 468]. Releases of *Trichogramma minutum*, Ril., have given good control of *Diatraea saccharalis*, F., on sugar-cane in Sinaloa.

Rodríguez (S. J.). **El gusano rosado del algodonero** (*Pectinophora gossypiella*, **Saunders) en la zona de Ojinaga, Chihuahua. Generalidades.** [The Pink Bollworm (*Platyedra gossypiella*) in the Region of Ojinaga, Chihuahua. General Observations.]—*Fitófilo* **1** no. 4 pp. 13–24, 3 figs. San Jacinto, D.F., Mex., 1942. **El gusano rosado del algodonero** (*Pectinophora gossypiella*, **Saunders). Su control.** [Control Measures.]—*T.c.* no. 5 pp. 3–18.

Platyedra (*Pectinophora*) *gossypiella*, Saund., which first appeared on cotton in the region of Ojinaga, Mexico, on the borders of Texas, in 1928 or 1929, was

responsible for the loss of half the crop there in 1937. In the first of these papers, all stages of the insect are described, and an account is given of its life-history. Observations have shown that the average durations of the stages in Ojinaga are 4·5 days for the eggs, 10 days for short-cycle larvae in squares and 17 for those in bolls, and 8 days for the pupae. The long-cycle larvae pass the winter in diapause in seeds (single or double), in the soil or rubbish on it, and in bolls left on the plants or on the ground; some do not pupate until they have remained in diapause over two winters. Adults from overwintering larvae began to emerge in March, maximum emergence taking place in June. Adults survived for about 12 days, and had a preoviposition period of 3–4 days. About 90 per cent. of the newly hatched larvae die through lack of food, excessive heat, the action of natural enemies and other causes, and some 20 per cent. of the feeding larvae and the pupae also die. Attempts to establish the parasite, *Bracon* (*Microbracon*) *mellitor*, Say [*cf. R.A.E.*, A **26** 275; **28** 577] gave poor results, and laboratory tests with *Pediculoides ventricosus*, Newp., were begun. Control measures are reviewed, and a list is given of those that have proved successful in a campaign in Ojinaga.

The second paper contains a detailed account of the campaign which was begun in 1938. It was found that long-cycle larvae represented about 22 and 53 per cent. of the population on 1st and 15th October, and 79 and 100 per cent. on 1st and 15th November. During the first year, seed of the usual variety was sown, after fumigation, as early as possible, and the fields were cultivated to ensure an early crop and thus permit the ground to be cleared before many of the larvae had entered hibernation. The percentage of bolls infested during the second half of August was 83·12, with an average of 4·14 larvae per infested boll; only 453 bales of lint were produced, of which 47·6 per cent. was of high commercial grades, compared with an average of 1,936 bales for the previous five years. Clearing was begun in early October, though the harvest was scarcely completed in some places. All the refuse and stubble in the fields were burnt, and all ginning waste was burnt daily during the season, and the seed sterilised by heat and sent away for industrial use. In the winter, the fields were ploughed to expose overwintering larvae and, where possible, irrigated.

In 1939, an early variety of cotton was selected, to permit early harvesting, and it was decided to sow it late, so that as many first generation larvae as possible would die through lack of food. Tests had shown that crops sown on 28th March, 20th April and 10th May flowered on 8th June, 16th June and 2nd July, and that the numbers of infested flowers per acre were about 9,092, 2,200 and 932, respectively. Since sowing in May would unduly delay the harvest, 20th April was fixed as the earliest date for sowing, and all crops sown earlier and ratoon cotton were destroyed. As a result, the percentage of infested bolls in August fell to 4·72, with an average of 1·81 larvae per infested boll, and 612 bales of lint were produced, of which 77·8 per cent. was of high grade. The fields were cleared and winter measures carried out as before. The same programme was followed in 1940 and 1941, and in the latter year, the percentage of bolls infested was 2·15, with an average of 1·28 larvae per infested boll, and 2,175 bales of lint were produced, the percentage of high grades being 83·94.

Delgado de Garay (A.). **El barrenador de la caña de azúcar** (*Diatraea* **sp.**). [The Sugar-cane Moth Borer.]—*Fitófilo* **1** no. 5 pp. 31–37, 3 figs. San Jacinto, D.F., Mex., 1942.

Diatraea saccharalis, F., is widely distributed in Mexico and causes considerable damage to sugar-cane, but little is done for its control. *Trichogramma minutum*, Ril., has been released against it and is stated to have given good results in Sinaloa and Nuevo León. A list is given of other parasites of the Pyralid that could be introduced.

Nelson (O. A.) & Smith (C. M.). **The Colloid Chemistry of Insecticides.**—[*In*] Alexander (J.) Ed. Colloid Chemistry **6** pp. 268–273, 36 refs. New York, N.Y., Reinhold Publ. Corp., 1946.

This is a discussion based on the literature of the various ways in which colloids are of importance in insecticides. Although solid insecticides, which are generally very fine powders and are dispersed in water as sprays or in air as dust clouds, and liquid insecticides such as petroleum oils, which are dispersed directly into air to produce mists or are emulsified with water and then atomised, are generally in particles or droplets larger than colloids, they almost always include some colloidal material. Certain colloids are applied as accessory spray materials, and various colloidal phenomena, such as adsorption of fumigants by fumigated products, are observed.

Methods of measuring particle size and experiments on the correlation between particle size and toxicity are briefly reviewed. There appears to be little doubt that the finer particles of an insecticide are more toxic than the coarser ones, and it might therefore be desirable to prepare insecticidal material in truly colloidal form provided that it would not be too harmful to plant foliage. In some types of petroleum-oil emulsions, such as those prepared with miscible oils, the degree of dispersion may approach the colloidal, but these are less useful as insecticides than emulsions with larger drops, which, being less stable, deposit the oil on the sprayed surface more readily. When oils are applied directly as mists, however, effectiveness seems to be proportional to the degree of subdivision. When the liquid insecticide is dispersed as an aerosol, by heat or by the rapid evaporation of a liquefied gas in which it has been dissolved, the degree of dispersion is so great as to make the aerosol act very much like a fumigant.

The most direct use of colloids in insecticides is as adjuvants or supplementary materials that enhance the value of the insecticide, frequently without exercising any toxic effect themselves. Such materials include emulsifying agents, wetting agents, dispersing agents, deposit builders and adhesive agents, which are usually inorganic or organic colloidal substances. Colloidal adjuvants have also been used with mixtures of otherwise incompatible insecticides to overcome undesirable chemical reactions, and a number of preparations more or less colloidal in character have been found of value in residue removal. Other ways of using colloids include adsorbing substances that are insecticidally active, but too soluble, on fine powders, and employing smokes to keep vaporised rotenone or naphthalene from agglomerating into larger, less effective particles.

Beard (R. L.). **Studies on the Milky Disease of Japanese Beetle Larvae.**—*Bull. Conn. agric. Exp. Sta.* no. 491 pp. 503–583, 27 figs., 52 refs. New Haven, Conn., 1945.

In this paper the author deals in detail with some of the fundamental biological aspects of the relationships between *Popillia japonica*, Newm., and *Bacillus popilliae*, the bacterium that causes the form of milky disease that has been extensively used for its control in the United States, particularly those concerned with the mode of infection, the pathogenicity of the disease organisms and the factors that affect the bacterium and its transmission from host to host. He reviews the literature on the discovery of the bacterium, the development of methods of using it for control and the insects against which it is effective. The following is based on his summary.

B. popilliae is a slender, non-motile rod in its vegetative form and forms spores of characteristic shape. Its normal invasion route is by the alimentary tract of the larvae. Both the vegetative and spore forms seem to be infective, but the spores apparently germinate before reaching the locus of infection,

the blood (haemolymph). Evidence indicates that the Malphigian tubules are the most probable site of bacterial penetration from the gut to the blood, though this is not proved. Infected grubs do not necessarily die as soon as the diseased condition is complete, but sometimes live and feed for variable lengths of time, presumably depending on the vigour of the individual; young grubs die sooner than older ones. Although the disease does not cause prompt death, it inhibits moulting and metamorphosis. The bacteria develop solely in the blood of the larva, and there is no apparent disturbance of the other body tissues or organs. Changes in the inorganic chemical constituents, osmotic pressure or pH of the blood, the number of blood cells, or the manner and time of blood coagulation are too slight to account for the total effect of the disease, but it has been found that at least one oxidising enzyme system is commonly disturbed, and since it is probable that oxidising enzymes are necessary for moulting, metamorphosis and normal length of life, it is considered that the bacteria may destroy one or more enzyme systems.

The probability that a larva will become infected increases with the spore dose, whether received by injection into the body cavity or by ingestion into the gut with food, the three instars appearing equally susceptible. There was no significant difference in susceptibility between larvae fed before inoculation and those removed from cold storage at the time of inoculation or between larvae inoculated at temperatures of 75 and 85°F. A single test showed that fresh spores were six times as toxic as spores in dust form; spores showed no loss of potency when stored as dried blood films or when exposed to weather in the soil, but a marked reduction when exposed to ultra-violet light from a sun lamp or heated to temperatures above 194°F., and some loss when refrigerated in a water suspension. Although low pH appears to have an adverse effect on the spores of *B. popilliae*, the pH of soils usually encountered in Connecticut has no significant action on their potency. The effect on potency of successive passages of the bacteria through a series of hosts is not well defined; increased potency was observed, but was not maintained consistently. The average number of spores produced per larva approximates 2,000 million. The number produced is not correlated with the body weight of the host, the temperature of incubation, provided that this is favourable, or the size of inoculum.

Healthy grubs sometimes acquire the disease by biting diseased individuals, but more commonly by ingesting spores with their food. Disintegration of diseased grubs after death serves to liberate spores in the soil. Although intact grubs may serve as sources of spores in the transmission of the disease, dissemination is much more prompt when the spores are in direct contact with the soil. Several experiments demonstrated the importance of heavy grub populations for a rapid spread of the disease, and a large amount of inoculum also favours spread. A heavy grub population can compensate for a small amount of inoculum and a large amount of the latter for a small population in causing a high incidence of the disease. The spread of the disease was observed over periods of time among third-instar larvae and among developing populations of larvae bred under different conditions. In several instances, an increasing inoculum resulting from the presence of dead larvae did not result in a progressive increase in the incidence of disease; instead, a period of increasing mortality was followed by a decline, probably because the infection rate exceeded the mortality rate at first but was then exceeded by it. The slower infection rate may be due in part to an accumulation of the more resistant grubs. As measured by bio-assay methods, the spores of *B. popilliae* tend to remain more concentrated in the top two inches of soil, but there is some vertical spread of spores applied to the surface.

The importance of *B. popilliae* as a parasite of *P. japonica* is discussed, and comparisons are made between infection trends of the milky disease and characteristic epidemic curves.

Parker (R. L.). **Additional Host and Distribution Records of the Sweetpotato Leaf Beetle,** *Typophorus viridicyaneus* **(Crotch) (Coleoptera, Chrysomelidae).** —*J. Kans. ent. Soc.* **19** no. 1 pp. 11–12, 5 refs. Manhattan, Kans., 1946.

The author reviews the distribution of *Typophorus viridicyaneus*, Crotch, in the United States, adds two States to the list of 19 from which it has been recorded [*cf. R.A.E.*, A **35** 23], and also reports its collection from six additional counties in Kansas. Its food-plants there included *Convolvulus arvensis* and dock [*Rumex*] ; those from which it has previously been recorded in the United States are sweet potato and wild species of *Ipomoea*.

Jensen (D. D.). & Holdaway (F. G.). **DDT to control Hide Beetles.**—*J. econ. Ent.* **39** no. 3 pp. 283–286. Menasha, Wis., 1946.

Since rabbit skins shipped from Hawaii to the mainland of the United States for felt manufacture were severely damaged in transit by *Dermestes maculatus*, Deg. (*vulpinus*, F.) and *D. ater*, Deg. (*cadaverinus*, F.) [*cf. R.A.E.*, A **34** 274], investigations on their protection were carried out at Honolulu. DDT proved so much superior to the other materials used in preliminary tests [**35** 68] that the final tests were confined to it. Some hides had been dried and had become infested before treatment and others were treated before drying and before exposure to infestation. Sprays containing 1, 2, 3, 4 and 5 per cent. DDT dissolved in benzene or kerosene were applied to dry and fresh hides at approximately 20 cc. per hide and dusts of 1, 2, 3, 4, 5 and 10 per cent. DDT in pyrophyllite or talc to dry hides at 1, 2 and 3 lb. per 50 lb. hides and to fresh hides at about 5 gm. per hide. Tests in which the skins were exposed to infestation by adults and eggs during the drying period, but protected from subsequent infestation, showed that all the DDT sprays and dusts gave complete kill of adults and newly hatched larvae, and tests in which they were exposed to continual infestation by adults and larvae that all the treatments gave excellent protection for at least 371 days ; there was no evidence of feeding on skins treated with the 10 per cent. dust or with the 2–5 per cent. sprays, negligible feeding on those treated with 2–5 per cent. dusts, and feeding on not more than 5 per cent. of the surface of those treated with the 1 per cent. spray or dust. Oviposition was not prevented by treatment with DDT, but was reduced in direct proportion to the concentration applied. Sprays were more toxic than dusts to the adults and more effective in reducing oviposition. DDT did not prevent hatching, but killed all the larvae before they caused any perceptible injury.

Usinger (R. L.). **Biology and Control of the Ash Lace Bug,** *Leptoypha minor*.— *J. econ. Ent.* **39** no. 3 pp. 286–289, 2 figs., 2 refs. Menasha, Wis., 1946.

Leptoypha minor, McAtee, of which the last-instar nymph is described, is the commonest species of its genus in California, where it occurs on ash (*Fraxinus velutina* and *F. oregona*) along roads and in parks and forests and has been recorded from Arizona. At Davis, hibernating adults of this Tingid were found clinging to the bark of ash trees throughout the winter. The eggs are deposited in the leaf tissue at the sides of veins on the undersides of the leaves, the first appearing in late April, after which breeding is continuous until late October. Development lasted 38 days in August, and it seems possible that there are four or five generations a year in the vicinity of Davis, where the population reaches injurious numbers by late summer. The nymphs live in colonies on the undersides of the leaves. Signs of infestation are the cast nymphal skins, whitened leaf areas caused by their feeding and numerous black faecal spots. At times, nearly every leaf is infested so that all the foliage appears discoloured, but the bugs are not known to kill the trees.

Applications of 1 per cent. oil emulsion combined with nicotine sulphate (1 : 1,200) or with a pyrethrum insecticide (2·5 per cent. pyrethrins) at the

same strength and of lauryl thiocyanate (1 : 400) with a spreader gave 93·8, 78·2 and 54·2 per cent. mortality, respectively, of nymphs and adults in 24 hours, while a mixture of 80 per cent. dispersing oil (75 per cent. western olefene base oil and 25 per cent. of a fatty condensation product) and 20 per cent. of a derris extract (5 gm. rotenone per 100 cc.), diluted with water (1 : 800) and applied at the rate of 13–20 U.S. gals. spray per tree, gave complete control of nymphs and adults though it failed to kill the eggs. Two thorough applications of the last spray directed especially to the undersurfaces of the leaves, at an interval of 2–3 weeks are therefore recommended.

Wilson (H. F.) & Jackson (M. L.). **Effect of Mineral Composition and Particle Size in Dispersants on Toxicity of Rotenone Dusts.**—*J. econ. Ent.* **39** no. 3 pp. 290–295. Menasha, Wis., 1946.

The authors describe investigations on the effect of mineral dispersants, mainly talcs containing a high proportion of magnesium and silica and pyrophyllite clays containing a large proportion of alumina and silica, on the efficiency of dusts containing rotenone as cubé or derris. Plants that had been infested with pea Aphids [*Macrosiphum onobrychis*, Boy.] 24 hours before were dusted with 200 mg. of the mixtures under test at a pressure of 20 lb. and examined for dead Aphids 24, 48 and 72 hours later. From the results obtained it is concluded that the presence of small particles, particularly in the colloidal size range, has a hindering effect on the toxic value of rotenone dusts. When the average particle size of the dispersant was 2·25–3·2 microns, rotenone dusts were more toxic than when it was 3·35–4·3 microns or 1·9 microns or less. The colloidal particles found in many dispersants tend to cover the cubé and derris particles so that they cannot come in contact with the insect. The main sources of colloidal particles in dispersants are free ferrous and ferric oxide and mineral chlorites (especially those high in ferrous iron) that are easily fractured to small particle size. Pure quartz was found to be the best available dispersant for rotenone, but is undesirable because of its high abrasive qualities. The aluminium silicate known as Pyrax (pyrophyllite, quartz and mica) was found to be an excellent dispersant, because, being comparatively free of either ferrous or ferric iron, it contained few colloidal particles. Since it contains a large proportion of quartz, it has the properties of quartz, but less abrasiveness than pure quartz because of the lubricating properties of the pyrophyllite. Talc is a good dispersant when few colloidal particles are present, but if it contains much ferrous or ferric iron, there are usually enough colloidal particles to effect the efficiency of rotenone dusts. Neither ferrous nor ferric iron had a direct deleterious chemical effect on rotenone.

Ambush Bugs killing Bees.—*J. econ. Ent.* **39** no. 3 p. 295. Menasha, Wis., 1946.

In June 1946, it was reported from Doddridge County, West Virginia, that many honey bees on sweet clover [*Melilotus*] had been killed by an insect that was identified as *Phymata wolffii*, Stål. This Phymatid was present in very large numbers on sweet clover and other plants frequented by bees, and three or four were often observed attacking a single bee.

Martin (C. H.) & Finney (G. L.). **Control of the Sex Ratio in** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **39** no. 3 pp. 296–299, 6 refs. Menasha, Wis., 1946.

The authors describe the technique used in the mass-rearing of *Macrocentrus ancylivorus*, Rohw., in California to increase the mating of the adults and consequently the proportion of females in the progeny [*cf. R.A.E.*, A **34** 306], which has not equalled that found in the field. The parasite cocoons are put in

one of two mating rooms at 9 a.m., and 24 hours are allowed for the parasites to emerge and mate in light of low intensity. At 9 a.m. next day the parasite adults are collected and the parasite cocoons moved to the other room. The 24-hour period is considered long enough for the females to become properly impregnated, since there was no change in the sex ratio of the offspring when the parasites were kept in the mating room for 28 hours. Reducing the intensity of light until a photographic light meter scarcely registered it increased the average percentage of females in the progeny from 33–42 to 52 by preventing excessive activity in both sexes. The proportion of females averaged 7 per cent. less in July–August than in May–June because the outside light was more intense and the sun shone more directly into the room. It was low in April, when the temperature fell to 55°F., and reduced mating, and highest in September, when the average temperature was 83°F., possibly reducing the time required for impregnation. There was no relation between the average number of parasites per square foot of wall and ceiling or the proportion of males and the sex ratio of the progeny at the lower light intensities. Superparasitism by supposedly impregnated females increased the proportion of females in the progeny.

MUNDINGER (F. G.). **The Control of Spittle Insects in Strawberry Plantings.**—*J. econ. Ent.* **39** no. 3 pp. 299–305, 5 figs., 4 refs. Menasha, Wis., 1946.

Philaenus leucophthalmus, L., which is polyphagous, injured strawberry in New York by feeding on the crowns, leaves, stems and fruits, and the froth produced by the nymphs is objectionable to pickers. Observations on the life-history of this Cercopid showed that the nymphs hatched from overwintered eggs in April and May and passed through five instars in 4–7 weeks. The first adults appeared early in July, and oviposition began in this month but was commonest in September and October. Females caught in September laid 18–51 eggs in masses of 1–30, usually in a leaf axil near the ground. The adults persist on vegetation until they are killed by frosty weather in autumn.

Details are given of experiments on control carried out on strawberry and lucerne in 1939, 1940, 1944 and 1945, and it is concluded from the results that rotenone is the most effective insecticide for the control of *P. leucophthalmus* on strawberry. A dust containing 1 per cent. rotenone, with or without an oil conditioner, used at the rate of about 50 lb. per acre, and a spray of 5 lb. derris (5 per cent. rotenone content) per 100 U.S. gals. water with a spreader, applied at 300 U.S. gals. per acre, were equally effective and reduced the population of the bug considerably ; with optimum weather conditions and timing, a 0·5 per cent. rotenone dust with an oil conditioner, applied at about 50 lb. per acre, gave satisfactory control. A dust of 5 per cent. DDT with an oil conditioner was also very effective, and lower concentrations of DDT showed promise. Dusts containing other insecticides did not, but hydrated lime applied at 500 lb. per acre under favourable conditions gave considerable protection. The timing of the treatments is important, the optimum time being when most of the eggs have hatched but before many of the nymphs have reached the fourth or fifth instars, usually between the middle and end of May. The material should be applied so that all masses of froth on the plants are treated.

FULTON (B. B.). **Dusting Blueberries to control the Cranberry Fruitworm.**—*J. econ. Ent.* **39** no. 3 pp. 306–308, 4 refs. Menasha, Wis., 1946.

The fruits of the cultivated highbush blueberry in North Carolina are attacked by *Mineola vaccinii*, Ril., which has been increasing in numbers for several years and caused serious injury in the early crop on some farms in 1944 and more widespread damage in 1945, *Conotrachelus nenuphar*, Hbst., which is less injurious, and an unidentified Lepidopterous larva of minor importance.

In 1945, cocoons of *M. vaccinii* were collected from just below the surface of the soil within a few inches of blueberry bushes on 21st March, and adults emerged from them during about the first two weeks of April and lived till towards the end of the month. Eggs were observed in the field from 5th to 16th April and larvae from 12th April. Cocoons were found from 30th April in the insectary, and most of the larvae in the field had left the berries by 14th May. Owing to unusually warm weather in March, the seasonal history was 2–3 weeks more advanced in 1945 than in 1944.

Dusts of cryolite, sulphur and talc (70 : 10 : 20) and of 3 per cent. DDT were applied on the night of 11th April at the rate of about 20 lb. per acre, and counts of the number of withered berries per bearing twig on 2nd May showed 0·42 and 0·49, respectively, for the two treatments, as compared with 3·23 for no treatment. A 1 per cent. rotenone dust, applied on 26th April to some of the plants, apparently gave no improvement in control. Of 137 withered berries from a plot dusted with cryolite, 40 per cent. were damaged by *M. vaccinii*, 24 per cent. by *C. nenuphar* and the remainder by undetermined causes. The relative proportion of *Mineola* larvae was much higher in the untreated plot, indicating that the reductions in damage were mainly due to their control. Eggs of *Conotrachelus* were found in berries a week before the first dust was applied, so that earlier treatment would be needed to control it. The cryolite and DDT dusts caused slight injury to the fruit, but the number of berries affected at picking time was so small that they were not considered objectionable in the pack. Attempts to use DDT to poison larvae that were entering the soil to pupate, by applying a spray of 4 lb. wettable powder (20 per cent. DDT) per 100 U.S. gals. water round the bases of undusted bushes or by throwing small handfuls of 3 per cent. dust against the base from two directions when some of the larvae had reached the last instar but none had entered the ground, were unsuccessful, and in the laboratory, larvae that made their cocoons in sand over which 3 per cent. DDT had been sprinkled were uninjured.

Filmer (R. S.) & Smith (C. L.). **Sabadilla and DDT to control the Hairy Chinch Bug.**—*J. econ. Ent.* **39** no. 3 pp. 309–313, 1 ref. Menasha, Wis., 1946.

Severe injury in New Jersey to turf consisting of bent grass [*Agrostis*], observed in May 1945, was found to be due to infestation over a number of years by *Blissus hirtus*, Montd. Preliminary tests having shown that sabadilla and DDT were toxic to overwintered nymphs and adults of this Lygaeid, detailed investigations were carried out with these materials. Experiments with power dusters showed that thorough coverage of turf could be obtained by applying about 100 lb. dust per acre when trailer cloths were used, but that a somewhat higher rate of application was necessary with hand equipment, and in small plot tests made in May and June, dusts containing 1, 3, 5, 10 and 25 per cent. DDT and 2·5, 5 and 10 per cent. sabadilla were applied at that rate. Both insecticides gave practically complete control at concentrations of 10 per cent. or more, but lower concentrations were comparatively ineffective. The dusts stimulated the bugs to greater activity, causing them to receive a more thorough coating, and this effect was more pronounced with sabadilla and greatly accelerated at higher temperatures. Sabadilla caused paralysis in a few hours and death within 48 hours, whereas DDT made the insects torpid for 4–5 days before death occurred, so that it was impossible to evaluate its effect in less than five days. Dusts containing 10 per cent. or more DDT showed a residual toxic action for periods of 10–14 days, so that under normal climatic conditions, nymphs hatching from eggs present when the dust was applied would be killed, but DDT at lower concentrations and sabadilla showed none.

In large-plot tests of dusts applied with a trailer, 1 per cent. rotenone, 10 per cent. sabadilla and 5 and 10 per cent. DDT reduced the number of bugs per square foot by 73, 90, 76 and 97 per cent. within a week. The relatively poor

result for sabadilla may have been due to migration, of which there was some indication in the plots dusted with 10 per cent. DDT, where the surviving insects were recovered from the edges. When 2·3 and 4·6 lb. 10 per cent. sabadilla with 42 lb. sand per 1,000 sq. ft. (equivalent to 100 and 200 lb. 10 per cent. sabadilla per acre) and 150 lb. 5 and 10 per cent. sabadilla dust per acre were compared, the reductions in population were 81, 90, 67 and 92 per cent. after five days. Although 10 per cent. sabadilla dust was again less effective than in the preliminary tests, it constantly showed sufficient toxicity to be considered as a practical treatment.

In large-scale tests, a dust of 10 per cent. DDT, applied in calm weather at the end of June at the rate of 100 lb. per acre by means of a power duster with a 30-ft. trailer, eliminated an infestation averaging 23 bugs per sq. ft. for the rest of the season, and the same dust applied in August eliminated infestations averaging 40–95 per sq. ft., whereas 2–3 applications of 1 per cent. rotenone appeared ineffective. A spray of 2 lb. wettable DDT powder (5 per cent. DDT) per 100 U.S. gals., applied to the turf at the rate of 600–800 U.S. gals. per acre in July, reduced an infestation from 117 to 6 bugs per sq. ft. seven days after treatment, although over five inches of rain fell during this time, and later inspection showed that infestation was kept under control for the whole season by this single application. Treatment of dense mixed bent grass turf on 12th July with a top dressing with which DDT was incorporated at the rate of 40 lb. per acre, reduced the number of bugs per sq. ft. from 36 to 1 by 27th July, when the number in untreated turf had increased to 41, and no bugs were found for the rest of the season. The dense high-cut turf of this test presented rather difficult conditions for control, and as a period of ten days was required for the top dressing to work down to the base of the plants, the kill was rather slow, but it is considered that future tests with top dressing will show that satisfactory control can be obtained with smaller quantities of DDT.

PLANK (H. K.). **The Control of Storage Insects in Corn Seed.**—*J. econ. Ent.* **39** no. 3 pp. 314–319, 1 fig., 8 refs. Menasha, Wis., 1946.

The following is based on the author's summary. In warm climates, maize seed becomes heavily infested by *Calandra* (*Sitophilus*) *oryzae*, L., soon after harvest, and, if kept under natural conditions, quickly loses its viability because of further attack by this and other storage insects. Experiments using sweet maize in Porto Rico showed that dipping the newly harvested ears in a freshly prepared water suspension of copper carbonate, with or without a wetting agent, did not prevent either early or late infestation, and mixing copper carbonate dust with the shelled seed (1 : 448), as recommended for smut control, one month after harvest, was equally ineffective, although it tended to hasten sprouting. Phenothiazine at the same rate was ineffective and seemed to injure the seed. A micronised grade of phenothioxin (phenoxanthiin) containing 46·5 per cent. bentonite kept the infestation lower for a longer period than any other treatment except fumigation with carbon bisulphide and isolation, but with no significant improvement in germination. Over a period of six months, none of these dust treatments of shelled seed gave more satisfactory results than similar treatment with hydrated lime at 1 part to 40 parts by weight.

Rolling the partly dried ears in hydrated lime alone or with copper carbonate, phenothiazine or phenothioxin bentonite when the grains had separated enough for the dust to penetrate to the cob (about three days after harvest) retarded early infestation and prevented serious damage during the first month after harvest. The dosage in all cases was adjusted so that the proportions of lime and added chemical would be equivalent to 1 part by weight to 40 and 448 parts, respectively, of seed after shelling (about 8 oz. per 100 ears).

However, during the next five months of common storage, none of these mixtures produced significantly better control of germination than hydrated lime alone, and considering the availability of material and practicability of timely application by a farmer having seed to be kept in common storage, rolling the partly dry ears in hydrated lime gave the most satisfactory results.

HALLOCK (H. C.). **Beet Leafhopper Selection of Bean Varieties and its Relation to Curly Top.**—*J. econ. Ent.* **39** no. 3 pp. 319–325, 1 fig., 12 refs. Menasha, Wis., 1946.

Since the curly-top virus [*Chlorogenus eutetticola* of Holmes] which is transmitted by *Eutettix tenellus*, Baker, reduces the yield of many important varieties of garden beans (those eaten green) in southern Idaho and limits the area in which they can be grown, investigations were carried out to determine whether it affects all varieties of garden beans to the same extent and to obtain additional information as to areas in south-central Idaho in which susceptible varieties of beans can be grown during years of high populations of the leafhopper. In cage tests in which 20 varieties of garden beans were compared with a variety of field bean very resistant to the disease, all the garden beans were significantly more attractive to females of *E. tenellus* than the field bean, and in greenhouse tests in which 19 varieties of garden beans and three of field beans were subjected to heavy infestation by viruliferous leafhoppers, six varieties of garden bean developed significantly higher percentages of infection than the other 13, and all the garden varieties significantly more than the field beans. Annual surveys of field and garden beans made at about the middle of July from 1935 to 1945 to determine the losses caused by curlytop showed that the varieties most severely injured in the greenhouse were also most severely injured in the field, the greatest damage occurring in areas in which the leafhopper populations were high. The results indicate that in years of medium leafhopper populations, three of the common varieties of garden beans can be grown in south-central Idaho with less danger of loss from curly-top disease than the others, and it is concluded that losses in bean yields can be reduced by avoiding the use of highly susceptible varieties in years in which high leafhopper populations are expected.

CLANCY (D. W.). **Natural Enemies of some Arizona Cotton Insects.**—*J. econ. Ent.* **39** no. 3 pp. 326–328, 6 refs. Menasha, Wis., 1946.

Observations on natural enemies of three insects attacking cotton in the Yuma Valley region of Arizona and California were made in 1937. The most injurious cotton pest in this region is *Euschistus impictiventris*, Stål, which migrates from other plants to cotton as the bolls are forming. On 26th July, there were on an average nearly two adults per plant in one field in Arizona, and numerous egg-masses, many of which were parasitised by *Telenomus mesillae*, Ckll. (*ashmeadi*, Morrill) or were being consumed by *Collops marginellus*, Lec. The predator destroyed more than twice as many eggs as the parasite, and the two together eliminated an average of 61·4 per cent. of the eggs present. In laboratory tests in which *C. marginellus* and the predacious bugs, *Geocoris sonoraensis*, Van D., *Nabis ferus*, L., *Sinea undulata*, Uhl., and *Zelus renardii*, Kol., which are abundant in Arizona cotton fields, were offered eggs and nymphs of *E. impictiventris*, *C. marginellus* did not attack the nymphs and none of the Hemiptera attacked the eggs, though *S. undulata* and *Z. renardii* readily attacked first-stage nymphs provided that they were moving.

Chlorochroa sayi, Stål, occurred chiefly on lucerne until about midsummer, when it gradually replaced *Euschistus* on cotton, and as the bolls ripened, it migrated to grain sorghums. Of 1,704 eggs collected in July on lucerne at

Bard in California, across the Colorado River from Yuma, 6·9 per cent. gave rise to adult parasites ; six of these were *Ooencyrtus johnsoni*, How., and the remainder *Telenomus mesillae* [*cf. R.A.E.*, A **31** 286]. The degree of parasitism gradually increased as the season advanced, until on 4th October, 95·9 per cent. of 664 eggs collected from grain sorghums at Bard were parasitised, mainly by *T. mesillae*, though 17 examples of *T. podisi*, Ashm., were obtained. Since the egg parasites apparently required most of the season to develop effective populations, their greatest benefit was in reducing the numbers of overwintering adults ; the situation might be improved by mass releases of *T. mesillae* when infestation is heavy early in the season or by introducing other species that are more efficient against small host populations. Laboratory tests with the predators tested against *Euschistus* gave similar results, except that *Collops marginellus* was unable to penetrate the egg shell of *Chlorochroa*. Occasional examples of the Tachinid, *Gymnosoma fuliginosum*, R.-D., were reared from field-collected adults of *C. sayi*, but only 1·8 per cent. of adults collected on lucerne between 20th July and 1st October were parasitised.

Bucculatrix thurberiella, Busck, frequently causes severe damage to cotton foliage in the arid south-west, particularly during late summer. During the first instar, while it is mining the leaves, the larva is subject to attack by *Closterocerus utahensis*, Cwfd., the female of which paralyses the host and then deposits an egg in its body cavity. Although superparasitism is common, only one parasite develops in each host larva. The life-cycle of *C. utahensis* lasts only 12–15 days during mid-summer. Of 250 larvae of *Bucculatrix* collected from leaf-miners on cotton between 21st September and 26th October, 201 yielded parasites, but it was observed that parasitism did not become effective until late in the season. *Catolaccus aeneoviridis*, Gir., *Spilochalcis side*, Wlk., and undescribed species of *Haltichella* and *Hormius* were reared from cocoons of *Bucculatrix*, total parasitism averaging 24·2 per cent. *Catolaccus* was the most numerous, and only one adult of *Hormius* was obtained.

Parencia jr. (C. R.), Ivy (E. E.) & Ewing (K. P.). **Control of Bollworm and Cotton Flea Hopper by DDT.**—*J. econ. Ent.* **39** no. 3 pp. 329–335, 7 refs. Menasha, Wis., 1946.

The results are given of cage and field tests carried out in Texas in 1945 to compare the effectiveness of various sprays and dusts containing DDT for the control of insects attacking cotton. In preliminary tests of sprays containing DDT in different types of oil, atomised on tender cotton plants at rates corresponding to 1–20 U.S. gals. per acre, kerosene, xylene and three commercial preparations caused moderate to severe injury, and light mineral oil and heavy petroleum distillate (diesel oil) caused slight injury at high dosages, but none at less than 10 U.S. gals. per acre. The diesel oil caused moderate to severe injury only once, when a mist prevented evaporation of the oil for several hours.

In cage tests against third-instar larvae of *Heliothis armigera*, Hb., solutions of DDT in diesel oil, at 3 U.S. gals. per acre, gave much quicker kills than dusts of DDT in pyrophyllite at corresponding dosages of DDT, but effectiveness was about equal at the end of five days ; sprays of 3·6, 5·4 and 10·8 per cent. DDT in diesel oil, atomised at 3, 2 and 1 U.S. gals. per acre, respectively, gave approximately equal control, but the lowest strength was less effective at 2 and 1 U.S. gals. per acre ; and 3·6 per cent. DDT in diesel oil gave a much quicker kill than pyrophyllite containing 5 per cent. DDT or than an emulsion prepared by dissolving DDT in a minimum of xylene and emulsifying it in water to give 3·6 per cent. DDT, but there were no differences in effectiveness after five days. Fused dusts of 2·3 and 4·6 per cent. DDT in sulphur, prepared by adding melted DDT to melted sulphur, cooling and grinding, simple dusts of

1·4 and 4·6 per cent. DDT in sulphur, prepared by grinding the materials together, and dusts of 2·5 and 5 per cent. DDT in pyrophyllite all gave fairly good control, the fused dusts being rather more effective than the others.

In small field plots, 5 and 10 per cent. DDT in pyrophyllite, applied on 3rd, 9th and 14th August, gave better control of *H. armigera* than 2·5 per cent. DDT in pyrophyllite or than cryolite and sulphur (70 : 30), and all four dusts gave significant increases in yield. Fused dusts of 4·6 and 2·3 per cent. DDT with sulphur, simple dusts of 4·6 and 1·4 per cent. DDT in sulphur and pyrophyllite dust containing 5 per cent. DDT, applied on 11th, 15th and 20th August, all gave significant control of a heavy infestation and significant increases in yield, the 4·6 and 5 per cent. dusts being more effective than the weaker ones. In a small-plot test to compare sprays and dusts against *H. armigera*, two applications on 20th and 27th July of DDT in xylene emulsions at rates of 0·8 and 1·6 lb. DDT per acre per application gave satisfactory control, but it was evident by 1st August that both *H. armigera* and *Anthonomus grandis*, Boh., were increasing rapidly in some plots, and the whole area was therefore given five applications of 12 lb. calcium arsenate per acre and two of 4·6 per cent. DDT in sulphur between 3rd August and 25th August, resulting in an average yield of 1,963 lb. per acre, as compared with 844 lb. per acre on untreated ground.

In tests against *Psallus seriatus*, Reut., fused and simple dusts of sulphur containing 4·6 per cent. DDT applied on 30th May and 6th June or on 29th June and 12th July gave very high control for the season, reducing the average number of fleahoppers per 100 terminals for five weeks from 108·6 to 8·6 in one case ; 2·3 per cent. DDT fused with sulphur was also effective, but 1·4 per cent. DDT in sulphur gave less control and resulted in less increase in yield. On plots receiving eight applications of dust between 25th June and 4th August, the numbers of *Aphis gossypii*, Glov., per square inch of plant surface were 24·4 for calcium arsenate and pyrophyllite (50 : 50), 35·1 for DDT, pyrophyllite and calcium arsenate (5 : 45 : 50), 7·5 for DDT and pyrophyllite (5 : 95), and only 1·1 and 1 for DDT, pyrophyllite and 14 per cent. nicotine dust (5 : 88 : 7) and DDT, pyrophyllite, calcium arsenate and nicotine dust (5 : 38 : 50 : 7), as compared with 1·9 for no treatment, indicating that 1 per cent. nicotine gives excellent Aphid control, and that calcium arsenate caused a higher infestation than 5 per cent. DDT, and a mixture of calcium arsenate and DDT a much higher infestation than either alone, possibly because a combination of the two materials has a wider range of high toxicity to the more important Aphid predators. Records made in the field-plot experiments indicated that DDT did not give satisfactory control of *Anthonomus grandis*, and in one experiment six applications of DDT caused marked increases in populations of a species of *Tetranychus*.

Hills (O. A.) & McKinney (K. B.). **Damage by** *Euschistus impictiventris* **and** *Chlorochroa sayi* **to Sugar Beets grown for Seed.**—*J. econ. Ent.* **39** no. 3 pp. 335–337, 2 figs., 3 refs. Menasha, Wis., 1946.

Since insect-population studies in fields of sugar-beet grown for seed in Arizona have shown that *Euschistus impictiventris*, Stål, is present each year, although never in large numbers, field-cage experiments were carried out in 1944 to determine how much damage it causes to the seed crop and to compare the damage with that due to *Chlorochroa sayi*, Stål [*cf. R.A.E.*, A **30** 430 ; **32** 216]. Three males and three females were caged on each of the experimental plants from 3rd–6th May until late June, and the mature seed was then harvested, cleaned and analysed. Both Pentatomids caused significant reductions in the percentage of viable seed balls produced and in the number

of sprouts per viable seed ball, the tendency being for *C. sayi* to cause slightly more damage than *E. impictiventris*, though the differences were not significant.

West (F. T.). **Ecological Effects of an Aphid Population upon Weight Gains of Tomato Plants.**—*J. econ. Ent.* **39** no. 3 pp. 338–343, 2 figs., 2 refs. Menasha, Wis., 1946.

The author describes investigations on the effect of Aphid populations on their food-plants, using *Macrosiphum solanifolii*, Ashm., on tomato plants grown in nutrient solutions and taking the effect on the gains in weight as a representative factor that could be measured accurately and quantitatively.

In the first series of tests, in which weighed plants were infested with 50 or 150 Aphids each or left uninfested, and the number of nymphs produced and the final weight of the plants were ascertained after 21 days, a total initial infestation of 1,000 Aphids on 53·52 gm. initial weight of plant tissue gave rise to a final population of 16,306 nymphs, causing a reduction in the final weight of 33·7 per cent. as compared with uninfested plants ; the reduction was approximately 25 per cent. for plants with the lower initial population and 42 per cent. for those with the higher one. In the second series, weighed plants were infested with 115 nymphs each, the adults present after six days were removed and counted, and the nymphs were counted after a further six days, when the plants were finally weighed. The results showed that each gram of infested plant tissue carried 3·62 adults and their offspring for six days and 37·8 nymphs for an additional six days. Ten infested plants with a total initial weight of 23·5 gm. gained only 190·6 gm., whereas ten uninfested plants weighing 22·9 gm. gained 298·9 gm.

It is concluded that 40 or more Aphids per gram of plant tissue constitute a heavy or critical infestation that significantly affects the metabolism and growth of tomato plants, even under optimum conditions for plant growth.

Dews (S. C.) & Morrill jr. (A. W.). **DDT for Insect Control at Army Installations in the Fourth Service Command.**—*J. econ. Ent.* **39** no. 3 pp. 347–355, 2 figs. Menasha, Wis., 1946.

This report, most of which is noticed elsewhere [*R.A.E.*, B **35** 187], includes an account of investigations on the comparative value of DDT and other substances for the control of termites at military installations in the south-eastern United States. Various treatments were tried when replacements were made 14 months after construction at a station in Florida having tar-paper buildings originally resting on untreated wooden supports placed without footings directly in the soil. When uprights and blocks for footings were soaked in a solution of 10 lb. DDT in 25 U.S. gals. diesel oil for 24 hours and the same solution was sprayed into the hole and on the soil as it was added around the upright at 1 U.S. quart per hole of 4 cu. ft., no termites approached the posts in the next 16 months, there was none in the soil around them at the end of that time and the wood was new in appearance. The percentages of damaged posts among those set up in soil treated with a 5 per cent. aqueous solution of sodium arsenite (1 U.S. gal. per 5 cu. ft.) was 20·8, the damage being insufficient to cause structural failure of the timber. Treating the soil with a mixture of one part creosote and three parts diesel oil failed to protect 62·9 per cent. of the timbers, and the damage was usually severe. Sodium arsenite apparently did not leach out in heavy rain as much as creosote. Untreated uprights were almost completely destroyed below ground by rot and termites and reduced to shells above ground by termite feeding. In another test, a 10 per cent. solution of sodium arsenite in water at 1 U.S. gal. per 5 cu. ft. of trenching along foundations was incompletely effective and double the quantity gave control but damaged shrubbery outside the foundation wall.

KNOWLTON (G. F.), MADDOCK (D. R.) & WOOD (S. L.). **Insect Food of the Sagebrush Swift.**—*J. econ. Ent.* **39** no. 3 pp. 382–383. Menasha, Wis., 1946.

A list is given of the insects and other organisms found in the stomachs of 2,191 sagebrush swift lizards (*Sceloporus g. graciosus*) collected in Utah in 1930–45. The insects comprised over 20,000 adult and over 3,000 immature examples, and are identified at least to Order or family and in some cases to genus or species. There were many injurious range insects, including *Eutettix tenellus*, Baker, the mormon cricket [*Anabrus simplex*, Hald.] and grasshoppers, and others that breed on range land but subsequently injure crops in cultivated areas [*cf. R.A.E.*, A **31** 201].

SMITH (F. F.). **Normal Offspring produced by moribund Aphids treated with DDT.**—*J. econ. Ent.* **39** no. 3 p. 383, 1 ref. Menasha, Wis., 1946.

In small-scale laboratory experiments to compare the toxicity of DDT in aerosols, emulsions, solutions, suspensions and dusts to *Myzus persicae*, Sulz., moribund Aphids that had dropped from treated foliage, with their bodies shrivelled for lack of food, were found to produce healthy offspring for up to three days, and the latter established normal colonies when transferred to untreated food-plants [*cf. R.A.E.*, A **34** 45]. The Aphids dropped from the foliage at about the same rate after all treatments, but death was most rapid and fewest young were produced after treatment with the aerosols or emulsions ; solutions, suspensions and dusts were progressively less effective. In field experiments, both *M. persicae* and *Macrosiphum solanifolii*, Ashm., remained moribund on the soil under potato foliage for two days after treatment, and collected individuals gave birth to living young. The symptoms observed in the treated Aphids suggest that at least part of the action of DDT is that of a nerve poison, but if it enters or passes through the ovarian walls it does so without producing apparent symptoms in the unborn young, and if it affects the nerves of the reproductive organs, it does so without preventing the extrusion of the offspring.

KNOWLTON (G. F.) & HARMSTON (F. C.). **Insect Food of the Mountain Bluebird.**—*J. econ. Ent.* **39** no. 3 p. 384. Menasha, Wis., 1946.

Examination of the stomach contents of 194 mountain bluebirds (*Sialia currucoides*) collected in range areas and cultivated localities in Utah in 1934–45 showed the presence of 2,474 insects that could be recognised at least to Order and in some cases to species ; the relevant data are shown in tables. The majority of the insects recognised were injurious or probably injurious, though a few were beneficial parasites or predators. They included only 23 adults and four nymphs of *Eutettix tenellus*, Baker.

RILETT (R. O.). **Desiccators as Constant Humidity Chambers.**—*J. econ. Ent.* **39** no. 3 p. 385, 1 fig., 1 ref. Menasha, Wis., 1946.

The author describes and illustrates a desiccator that has been successfully used as a humidity chamber in life-history studies of *Laemophloeus ferrugineus*, Steph., and should prove of value for similar studies. Any desired humidity can be obtained within the desiccator by introducing into its basal part sulphuric acid and distilled water in the proper proportions.

RICHARDSON (C. H.). **DDT for Codling Moth Control.**—*J. econ. Ent.* **39** no. 3 pp. 391–393, 5 refs. Menasha, Wis., 1946.

An account is given of experiments carried out in 1945 in a large commercial apple orchard in Iowa, to determine the effect against a moderate infestation of *Cydia* (*Carpocapsa*) *pomonella*, L., of a rather heavy DDT spray schedule, extending well into the second-generation period and followed by lighter applications towards harvest, and to discover whether light applications

of DDT could prevent the increase of established populations. A dry commercial preparation containing 40 per cent. DDT was used, and all spray quantities are given per 100 U.S. gals. In the first series, the trees received a pre-blossom spray of 6 U.S. quarts lime-sulphur, a calyx spray of 3 lb. lead arsenate, 3 lb. hydrated lime and $6\frac{1}{4}$ lb. wettable sulphur and either five cover sprays of 1 lb. actual DDT between 1st June and 20th July followed by a sixth of 0·75 lb. DDT and a seventh of 0·33 lb. DDT with 3 lb. lead arsenate on 7th and 24th–30th August, respectively, or six cover sprays containing 4 lb. lead arsenate, with hydrated lime in the first and fourth and 0·8 U.S. gals. summer oil with high calcium hydrated lime and zinc sulphate as safeners in the third, fourth and fifth, followed by a seventh of 0·33 lb. DDT on 24th–30th August. Ferric dimethyldithiocarbamate was added to some of the DDT sprays and this fungicide or wettable sulphur to the corresponding sprays of lead arsenate. The results were estimated by successive examinations of fruits without removing them from the tree and are expressed as the percentage of apples infested (entered or superficially damaged) and the numbers of blemishes per 100 apples. The DDT schedule kept both numbers almost to zero until 19th July, after which they increased, infestation reaching 7·6 per cent. and the number of blemishes 8·6 by harvest, probably owing to the reduction in the concentration of DDT in the sprays. The lead-arsenate schedule resulted in 4·3 per cent. infestation at the end of the first generation on 3rd July, and, in spite of the substitution of DDT for lead arsenate in the final spray, in 35·8 per cent. infestation and 67·2 blemishes at harvest.

In the second series of tests, the trees received a calyx and four cover sprays of lead arsenate as before, followed by further cover sprays containing 0·25 lb. DDT with 4 lb. lead arsenate, 0·25 lb. DDT with 3 lb. lead arsenate and 0·33 lb. DDT on 17th July and 3rd and 25th August, respectively. The percentage infestation and (in brackets) number of blemishes were 10·8 (15), 27·2 (41·2) and 31·5 (52·8) on 26th July and 7th and 24th September, indicating that dosages of DDT as low as these, with or without lead arsenate, may not be sufficient to prevent definite increases in infestation.

Aphis pomi, Deg., leafhoppers and mites were present in small numbers and did not increase on trees sprayed with DDT. Foliage injury, apparently caused by DDT, appeared late in the season on one variety of apple ; it consisted of bronzing of the leaves but was not accompanied by abnormal leaf-fall.

Richardson (C. H.). **DDT for Control of the Apple Curculio.**—*J. econ. Ent.* **39** no. 3 p. 381. Menasha, Wis., 1946.

In the course of the first of two series of experiments on the control of the codling moth [*Cydia pomonella*, L.] on apple in Iowa with DDT and lead arsenate [see preceding abstract], records were made of the abundance of *Tachypterellus quadrigibbus magnus*, List. The first apples punctured by this weevil were found on 24th May, a slight increase in their numbers was noted a week later, and both new and old punctures were present on 12th June. By 10th August, few new punctures were found and the old ones were rapidly becoming indistinct.

The percentages of punctured apples on 12th and 21st June, 3rd and 19th July and 10th August were 2, 0·8, 1·1, 1·8 and 0·7 on the DDT plots and 1, 0·2, 2·4, 3·4 and 1·1 on the lead-arsenate plots, and it seems probable that 1 lb. DDT per 100 U.S. gals. is at least equal to 4 lb. lead arsenate per 100 U.S. gals. for controlling light infestations of this insect.

Turner (W. F.). **Distribution of Plum-feeding Species of *Macropsis*.**—*J. econ. Ent.* **39** no. 3 pp. 394–395, 1 fig., 6 refs. Menasha, Wis., 1946.

The Jassid, *Macropsis trimaculata*, Fitch, is known to be a vector of peach yellows [*Chlorogenus persicae* var. *vulgaris* of Holmes] in the United States [*cf. R.A.E.*, A **31** 392], but it is not known whether this virus is also

transmitted by other species of the same genus. *M. trimaculata* belongs to a small group of which the other members are *M. insignis*, Van D., which cannot always be distinguished from *M. trimaculata* by external characters or by any known female character, and a form found in the surveys referred to below that is considered by P. W. Oman to represent either a new species or a variety of *M. trimaculata*. The primary food-plants of these three forms are wild plums (*Prunus* spp.), and since they all frequently occur in mixed populations in plum thickets (as of *P. angustifolia*) or on individual plum trees (as of *P. americana*), there is little assurance that transmission tests in the past, except those of Manns [*cf. loc. cit.*] were carried out with pure populations of *M. trimaculata*. Two other plum-feeding species of *Macropsis* are *M. tristis*, Van D., which, though distinct from the *trimaculata* group, has similar habits and commonly occurs in mixed colonies with *M. trimaculata* and *M. insignis* through at least part of their range, and *M. quadrimaculata*, Breakey, which was only taken four times by the author.

As there were no records of *M. trimaculata*, *M. insignis* or *M. tristis* from south of the Ohio River in the Mississippi watershed or south of the northernmost counties in Virginia east of the Appalachians, although sporadic outbreaks of peach yellows have occurred as far south as North Carolina and Tennessee, and an active outbreak of the disease has been in progress in eastern Tennessee as far south as the Alabama border since 1936, surveys were made in 1939–42 to determine the southern distribution of all the plum-feeding species of *Macropsis*, particular attention being given to plum rather than peach. They have only one generation a year, and the adults are present from early June to mid-August. All species of wild plums occurring within their range appear to be natural food-plants, and no actual preference was noted when a choice was offered, the apparent importance of any one species of plum in a given locality being due simply to its prevalence. The counties that formed the southern margin of the area of distribution of *M. trimaculata*, *M. insignis* and *M. tristis* in Virginia, North and South Carolina, Georgia, Alabama, Mississippi, Tennessee, Kentucky, Missouri and Arkansas are indicated in a table and the southern limits of their distribution shown on a map. Each species was found in all these States except that *M. trimaculata* was the only one in South Carolina and was not found in Alabama, and *M. insignis* was not found in Mississippi. The ascertained distribution of *M. quadrimaculata* is also given ; it was taken in North Carolina and Tennessee.

SAKIMURA (K.). **Two Species of Thrips Non-Vectors of the Spotted Wilt Virus.**—*J. econ. Ent.* **39** no. 3 pp. 398–399, 5 refs. Menasha, Wis., 1946.

In tests made in late 1942 and early 1943, immediately after the discovery of *Frankliniella sulphurea*, Schmutz, in the Hawaiian Islands [*cf. R.A.E.*, A **35** 66], none of 468 adults of this thrips transmitted the spotted wilt virus [*Lethum australiense* var. *typicum* of Holmes] from infected to healthy plants of *Emilia sonchifolia*, a major weed host of the virus, though *Thrips tabaci*, Lind., the only known vector in Hawaii [*cf.* **29** 139], readily transmitted it from the same plants. In similar tests, none of 351 adults of *Anaphothrips orchidii*, Moult., which is well established in Hawaii, transmitted the virus, and it is concluded that neither of these thrips is a vector of spotted wilt.

CHISHOLM (R. D.), YETTER jr. (W. P.) & BRUNSON (M. H.). **Baits for the Oriental Fruit Moth.**—*J. econ. Ent.* **39** no. 3 p. 399, 1 ref. Menasha, Wis., 1946.

A highly efficient bait for adults of *Cydia* (*Grapholitha*) *molesta*, Busck, is prepared by emulsifying terpinyl acetate in a solution of saponin and mixing the emulsion with a solution of brown sugar. The terpinyl acetate is of extra

grade, which was found more attractive than the technical grade previously used in a similar bait [*R.A.E.*, A **21** 599]. This bait is the standard one at Moorestown, New Jersey, and is easily made in the laboratory, but as it is difficult to produce on a large scale, two modified forms of it were developed. For one, 10 ml. of a concentrate prepared by stirring together 3 gm. Tween 20 (a polyoxyalkylene derivative of sorbitan monolaurate) and enough terpinyl acetate (extra grade) to make 100 ml. mixture was shaken vigorously with 25 ml. water, and the resulting emulsion stirred into 5 U.S. gals. sugar solution containing 4 lb. brown sugar ; and for the other, a mixture of 3 gm. Tween 20, 10 gm. resin residue and enough terpinyl acetate to make 100 ml. was used in the same way, except that ten per cent. more of the mixture was used to compensate for the substitution of resin residue for some of the terpinyl acetate. These baits contained about 0·5 ml. terpinyl acetate per U.S. quart, the concentration that had been shown to give the best results in previous work.

Orchard tests carried out in the summer of 1945 in a lightly infested peach orchard under adverse weather conditions, with traps containing the two mixtures at concentrations of 0·5 and 0·25 ml. terpinyl acetate per U.S. quart of bait, showed that the first mixture increased the numbers of moths taken by about 20 per cent. and the second by about 30 per cent. as compared with the standard bait at the same concentrations.

ROBBIE (W. A.). **Use of Calcium Cyanide Solutions in HCN Toxicity Experiments with Insects.**—*J. econ. Ent.* **39** no. 3 pp. 400–402, 2 figs., 2 refs. Menasha, Wis., 1946.

An account is given of a method by which calcium-cyanide solutions saturated with calcium hydroxide are used as sources of hydrocyanic acid gas for quantitative experiments with insects. The solution is absorbed on cotton or filter paper in the bottom of a wide-mouthed jar, and a test tube containing the insects and covered with thin cloth is inserted through a hole in the rubber stopper. The concentration of hydrocyanic acid gas obtained depends primarily on the concentration of the cyanide solution and the temperature ; it soon reaches an equilibrium level in the jar and test tube and then remains constant indefinitely under controlled conditions. The concentrations of gas given off at 25°C. [77°F.] by solutions of calcium cyanide at various concentrations, each containing 10 per cent. calcium-hydroxide suspension, are shown in a table, and the results obtained when this technique was used with adults of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, and post-diapause eggs of *Melanoplus differentialis*, Thos., are given to illustrate the method.

SCOTT (L. B.). **Unusual Occurrence of the Corn Rootworm in Tennessee.**—*J. econ. Ent.* **39** no. 3 p. 402, 1 fig. Menasha, Wis., 1946.

Adults of *Diabrotica longicornis*, Say, appeared in large numbers on mid-season- and late-planted river-bottom maize plants in north-central Tennessee in July 1945 ; the number of beetles was estimated to be 100 per plant in one 300-acre planting. They occurred on all parts of the plants, but chiefly under leaf sheaths, where they caused no apparent damage, or in the silks, which they severed. Although fertilisation was complete in some ears from which all silks had been severed, indicating that they had been cut off too late to prevent fertilisation, it was usually reduced in direct proportion to the loss of silks. Damage increased until about 15th August, when only half the kernels in heavily infested plantings had been fertilised, but there was a marked reduction in infestation and a notable decrease in the number of unfertilised kernels by 24th August and the beetles had disappeared before 1st October, when about 95 per cent. of the kernels had been fertilised. It is doubtful whether the late-fertilised kernels would have matured in a normal season, but heavy rains in

September and a lack of killing frosts until the last week in November provided conditions favourable for maturation. The harvested crop had more than the usual number of misshapen ears, but ears with more than 15 per cent. unfertilised kernels were rare, and it appeared that losses did not exceed 5 per cent.

Small-scale preliminary tests indicated that an application of 25 lb. per acre of a dust containing 10 per cent. DDT in pyrophyllite reduced infestation from about 100 beetles per plant to less than one within an hour, the number increasing to 4–5 per plant in 14 days, when there were still 100 per plant in untreated acreas. A similar application of 3 per cent. DDT in pyrophyllite appeared to be equally effective, though infestation had been reduced by natural causes by the time it was made. No dead beetles were found in the treated areas. An application of 15 lb. lead arsenate dust per acre caused no noticeable reduction in the beetle population, though several dead beetles were found. Neither lead arsenate nor DDT caused discernible injury to the plants.

HERVEY (G. E. R.) & SCHROEDER (W. T.). **The varietal Response of Cucumbers to DDT Control.**—*J. econ. Ent.* **39** no. 3 pp. 403–404, 1 fig., 2 refs. Menasha, Wis., 1946.

In an experiment carried out in New York in 1944 to determine the value of DDT for the control on cucumber of *Diabrotica melanocephala*, F. (*vittata*, F.), one of the vectors of bacterial wilt of cucurbits (*Bacillus tracheiphilus*), talc dusts containing 10 per cent. calcium arsenate, 10 per cent. calcium arsenate with 13·5 per cent. copper oxychloride-sulphate, or 2 per cent. DDT were applied seven times to plants of the variety China at approximately weekly intervals during the period between the emergence of the seedlings and the formation of the first fruits. All treatments resulted in a rather marked reduction in the proportion of plants killed by bacterial wilt and gave a considerable increase in yield, the decreased yields of the untreated plots resulting partly from the death of plants from wilt and partly from stunting caused by the feeding of the beetles. DDT was superior to the other two dusts and caused no plant injury.

In 1945, these dusts and one (Rhothane) containing dichlordiphenyl dichlorethane were applied seven times to the plants of the varieties China, Chicago Pickling and Ohio 31 during the growing period, during which *D. melanocephala* was abundant, *D. duodecimpunctata*, F., present in small numbers and bacterial wilt much more prevalent than in 1944. The results with DDT on the first variety confirmed those of 1944, wilt control being outstanding and the yield much higher than for any other treatment, but although DDT gave very good control of wilt on Ohio 31, it caused severe stunting of the plants and only a small increase in yield. Plants of the variety Chicago Pickling that received DDT grew well and appeared vigorous until about the middle of August, when they became badly infested with *Aphis gossypii*, Glov., which caused the death of many of them and reduced the yield increase. Aphid infestation was general throughout the field, but was definitely injurious only on this variety and only when it had been treated with DDT. The mixture of calcium arsenate and copper oxychloride-sulphate gave somewhat better wilt control and better yields in most cases than calcium arsenate alone, and dichlordiphenyl dichlorethane had little value in controlling *Diabrotica* or bacterial wilt.

In preliminary greenhouse experiments on the phytotoxicity of DDT, plants of all three varieties were injured when DDT was applied as a spray, Ohio 31 being the most severely affected, but no measurable injury occurred when it was applied as a 3 per cent. dust, possibly owing to the lack of moisture on the leaves. It is concluded that before any commercial use can be made of DDT on cucumbers and related crops, further investigations are necessary on varietal susceptibility to injury and the factors that influence it.

Baker (W. L.). **DDT and Earthworm Populations.**—*J. econ. Ent.* **39** no. 3 pp. 404–405, 1 fig. Menasha, Wis., 1946.

Part of a dense stand of American elm [*Ulmus americana*] near Columbus, Ohio, was sprayed with an emulsified solution of DDT in September 1944. The spray, which contained 0·25 per cent. DDT, was applied until it dripped from the foliage. All the leaves had fallen a month later. There was very little rain during the winter. Heavy earthworm populations had been observed in the stand every spring since 1940, but in the middle of April 1945, although earthworms had removed nearly all the leaves from the ground below untreated trees, there was practically no evidence of activity in the treated area, and samples of 2 sq. ft. of soil taken to a depth of five inches in untreated and treated areas contained 95 and 27 worms, respectively, with practically no immature ones from the sprayed area. By the end of May, however, the earthworms had removed most of the leaves on the sprayed plot to their burrows and there was no noticeable difference between sprayed and unsprayed parts of the stand.

Hetrick (L. A.). **On the Biology of the Cowpea Curculio in Virginia.**—*J. econ. Ent.* **39** no. 3 p. 405, 2 refs. Menasha, Wis., 1946.

Observations on *Chalcodermus aeneus*, Boh., at Chatham, Virginia [*cf. R.A.E.*, A **35** 264] in 1944 and 1945 showed that it has only one generation a year there [*cf.* **27** 82, 644] and that development in cowpeas in the field from egg to prepupa and in the soil from prepupa to adult averaged 16 and 17 days, respectively. Only four of 200 adults in outdoor hibernation cages survived the winter, indicating that winter mortality of hibernating adults is high. *C. aeneus* was parasitised at Chatham by the Tachinid, *Myiophasia globosa*, Tns., and the fungi, *Beauveria globulifera* and *Metarrhizium anisopliae*. *Beauveria* is the most important ; it infests all stages except the eggs, causes a high mortality in late summer and early autumn, and also attacks adults that have survived the winter.

Owens (H. B.) & Ditman (L. P.). **Liquefied Gas Aerosols to control Insects on Eggplant.**—*J. econ. Ent.* **39** no. 3 pp. 405–406, 1 ref. Menasha, Wis., 1946.

Gargaphia solani, Heid., is probably the most important of the insects that attack egg-plant [*Solanum melongena*] in eastern Maryland, where it is impossible to grow a productive crop in some localities in which *S. carolinense*, the wild food-plant of this Tingid, is abundant. In one of these areas in 1945, aerosols for which the solution was 5 per cent. each of DDT, cyclohexanone and Velsicol AR-60 [an isomeric mixture of alkyl-substituted naphthalenes], 50 per cent. methyl chloride and 35 per cent. acetone were applied to the plants on 21st and 30th June, 7th and 27th July and 14th and 29th August by means of a hand-drawn dispenser, with a 9-ft. muslin trailer for the last three treatments, the rates of application of solution per acre being 3·3 lb. in June, about 5 lb. in July and about 8 lb. in August. The egg-plants were adjacent to maturing potatoes from which there was a heavy migration of several species of flea-beetles and the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], and the first two applications were made to the entire field, in order to save the young plants, and the remainder to all but ten plants, which were left for comparison. Although the crop continued throughout September, no treatment was necessary after the end of August. The treatments on 21st June, 7th July and 14th and 29th August resulted in reductions of over 90 per cent. in the population of *G. solani*, whereas those on 30th June and 27th July caused only 34 and 40 per cent. reduction. There were similar reductions of the other insects, except after the last treatment, when *L. decemlineata* was absent and

flea-beetles increased in numbers, probably because of immigration during the two days before counts were made. The effect of infestation by *G. solani* on the untreated plants could not be ascertained, but they were uniformly smaller than treated ones and generally lacked vigour, whereas treated plants were generally robust and produced an excellent crop of fruit of high quality.

BECKER (W. B.) & SWEETMAN (H. L.). **Leaf-feeding Sawfly Larvae burrowing in structural Wood.**—*J. econ. Ent.* **39** no. 3 p. 408, 1 fig. Menasha, Wis., 1946.

During August and September 1945, larvae of *Macremphytus* spp. were observed on the leaves of dogwood [*Cornus*] in several localities in Massachusetts, and in September, larvae tentatively identified as *M. tarsatus*, Say, were found in large numbers about buildings and burrowing into wooden structures to make pupal cells. The burrows varied from shallow pits, many of which had been abandoned, to deep holes in which larvae had completely embedded themselves, the latter being most abundant in wood that was decayed or naturally soft.

YOTHERS (M. A.) & CARLSON (F. W.). **Effect of sublethal Concentrations of Dinitro-o-Cresol on the Codling Moth.**—*J. econ. Ent.* **39** no. 3 pp. 407–408, 9 refs. Menasha, Wis., 1946.

The results are given of investigations carried out in 1942 and 1944 to determine the effect of sublethal concentrations of 4,6-dinitro-o-cresol [numbered with OH as 1], applied to the trunks of apple trees against the full-grown larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. [*cf. R.A.E.*, A **35** 131, etc.], on the number and viability of the eggs laid by moths that develop from larvae that survive the treatment. In 1942, cocooning sticks were dipped in an emulsion containing 1, 2 or 4 lb. dinitro-cresol, 4 lb. sodium lauryl sulphate, 5 U.S. gals. stove oil (viscosity 34 secs. Saybolt) and 3 U.S. gals. of a mixture of ethylene glycol monobutyl ether and trichlorethylene (1 : 1) per 100 U.S. gals. and allowed to dry for 11 days, and in 1944 they were sprayed with an emulsion of 1, 2 or 4 lb. dinitro-cresol, 15 U.S. gals. stove oil (viscosity 34 secs. Saybolt), ½ U.S. pint Triton B-1956 (a phthalic glyceryl alkyd resin), 1½ U.S. pints hydrochloric acid (37 per cent. c.p.) and 3 lb. Celite 209 (finely divided diatomaceous earth) per 100 U.S. gals. and allowed to dry for one day, after which they were fastened in bundles and caged with 500 freshly collected full-grown larvae. A roll of waxed paper was provided for oviposition. After no treatment and treatment with 1, 2 and 4 lb. dinitro-cresol in 1942, the percentages of larvae that gave rise to moths were 29, 27, 20 and 1, the average numbers of eggs per female 16, 5·3, 3 and 1·7 and the percentages of eggs that hatched 70, 71, 66 and 100, respectively. In 1944, the corresponding percentages of larvae that gave rise to adults were 53, 30, 2·4 and 1·8, respectively, but no females were produced in the last group and none in the third oviposited. Females of the first and second groups laid averages of 8·7 and 1·2 eggs, and of these, 92 and 72 per cent. hatched. It is concluded that moths developing from larvae that survive sublethal concentrations of dinitro-cresol deposit markedly fewer eggs than those that develop from untreated larvae and that the eggs deposited may be less viable than normal ones.

CARLSON (F. W.) & YOTHERS (M. A.). **Dinitro-o-cresol and DDT to control full-grown Codling Moth Larvae.**—*J. econ. Ent.* **39** no. 3 pp. 408–409, 4 refs. Menasha, Wis., 1946.

In tests on the persistence of toxicity to full-grown larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., of sprays of 4,6-dinitro-o-cresol [numbered with OH as 1] and DDT [*cf. R.A.E.*, A **35** 131], carried out in Washington in 1944, about 6 U.S. quarts of several mixtures of dinitro-cresol and one of DDT were sprayed

on 13th July on to the trunks, crotches and lower scaffold limbs (about 2 ft.) of apple trees without fruit, and 200 full-grown larvae, recently collected from bands, were released 4–7 days later on each tree and on comparable untreated trees. The test larvae were confined to the treated areas and others were kept off them by means of adhesive barriers. Records of living and dead larvae and of empty pupal cases were made twice a week, and 30 days after treatment all rough bark was removed, and final records were made. At this time and 30 days later, similar samples of larvae were placed on other trees that had been sprayed on 13th July, and similar records were kept for these.

The percentages of larvae that died during the three successive periods on unsprayed bark were 16, 24 and 16. The corresponding percentages for the various treatments were : 82, 68 and 79 for the regular spray of 4 lb. dinitro-cresol, 10 U.S. gals. stove oil, 4 U.S. pints Triton B-1956 (a phthalic glyceryl alkyd resin) and 3 U.S. gals. of a mixture of equal parts of ethylene glycol monobutyl ether and trichlorethylene per 100 U.S. gals., which was the only spray that gave high mortality for 90 days after application ; 39, 50 and 46 for a quick-breaking emulsion of 3 lb. dinitro-cresol, 15 U.S. gals. stove oil, ½ U.S. pint Triton B-1956 and 3·78 grains ferric chloride dissolved in 1 U.S. pint water per 100 U.S. gals.; 85, 49 and 44 for a mixture like the last, but with 4 lb. dinitro-cresol and 3 lb. diatomaceous earth (celite 209) in place of the ferric chloride ; 74, 34 and 32 for one of 4 lb. dinitro-cresol, ½ U.S. pint Triton B-1956 and 10 lb. bentonite per 100 U.S. gals.; and 85, 28 and 20 for an emulsion of 4 lb. DDT dissolved in 3 U.S. quarts benzene, ½ U.S. pint Triton B-1956 and 2 lb. diatomaceous earth per 100 U.S. gals.

These results indicate the possibility of greatly reducing populations of *C. pomonella* in an orchard by spraying the trunks and lower branches with dinitro-cresol during the summer to destroy larvae that have already cocooned and those that may cocoon later. The safety of summer applications of the dinitro spray has not been fully determined.

Carlson (F. W.) & Yothers (M. A.). **A Penetrant Aid for Codling Moth Trunk Sprays.**—*J. econ. Ent.* **39** no. 3 pp. 409–410, 3 refs. Menasha, Wis., 1946.

Earlier investigations showed that the addition of a penetrating agent improved the control of overwintering larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., on the trunks of apple trees given by sprays of 4,6-dinitro-o-cresol [numbered with OH as 1] [*cf. R.A.E.*, A **32** 273 ; **35** 131], but the one used in the tests, consisting of equal parts of ethylene glycol monobutyl ether and trichlorethylene, could not be recommended for practical use because of the difficulty of obtaining it. In recent laboratory and field tests, however, a finely divided diatomaceous earth (Celite 209) proved a satisfactory and cheap substitute, forming a deposit that assisted in the penetration of the emulsion through the waxy cocoons, and the author recommends the use of an emulsion containing 4 lb. dinitro-cresol, 15 U.S. gals. stove oil, ½ U.S. pint Triton B-1956 (a phthalic glyceryl alkyd resin) or other emulsifier, 3 lb. diatomaceous earth, 1½ U.S. pints hydrochloric acid and 6 U.S. pints acetone per 100 U.S. gals. spray. The acetone is used as a solvent for the dinitro-cresol, but this can be dissolved in the stove oil (1 lb. per 6 U.S. quarts) by heating. The acid is used to reduce the pH of the emulsion to 2–4, within which range it is most effective. This emulsion breaks on standing, but re-emulsifies with agitation. It gave kills of 99–100 per cent. in the laboratory and of 85 and 78 per cent. in the field in 1944 and 1945, respectively, as compared with 82 and 87 per cent. for the regular formula.

Whitehead (F. E.). **Codling Moth Traps in Oklahoma.**—*J. econ. Ent.* **39** no. 3 pp. 411–413. Menasha, Wis., 1946.

In 1942, when infestation of apples by the codling moth [*Cydia pomonella*, L.] was very severe in Oklahoma, properly equipped bait-traps did not catch

enough moths to be of use in determining suitable spray dates. Complete seasonal records were therefore made in 1943, 1944 and 1945 of catches in traps consisting of wide-mouthed jars with a capacity of 1 U.S. quart, covered with quarter-inch hardware cloth and containing 1 lb. brown sugar per 1 U.S. gal. water, with one or two drops of geraniol added to each trap and 5 gm. sodium benzoate per U.S. gal. added to the solution used to refill the traps a week after the bait was prepared. The daily catches in each season are given in a table and indicate that the traps were effective during the period of emergence of the overwintered generation, though the numbers of moths caught were much lower than those reported from more northern areas, but ineffective for the later generations. Since the apples in the orchard containing the traps were severely injured, the small catches must have been due to some factor other than moth population, and it is concluded that under the conditions existing in central Oklahoma, traps are useful in timing sprays against the first generation of *C. pomonella*, but not against later ones.

TATE (H. D.). **Earworm Control on Sweet Corn.**—*J. econ. Ent.* **39** no. 3 pp. 414–415, 5 refs. Menasha, Wis., 1946.

The results are given of investigations carried out in Nebraska in 1941–43 on the control of the corn earworm [*Heliothis armigera*, Hb.] on sweet maize by treatment of individual ears [*cf. R.A.E.*, A **34** 147, etc.]. Cutting off the silks and about half an inch of husk, with additional cuts where necessary [*cf.* **31** 509], in two trips through the field at an interval of 4–5 days, gave little if any protection. A white mineral oil (viscosity 200–250), applied at the rate of 0·5–0·75 ml. per ear about five days after silk exposure, gave significant increases in uninjured ears, and was as effective as oil with insecticide in 1943. Mineral oil (viscosity 100–150) with 0·2 per cent. pyrethrins and mineral oil with 2 per cent. dichlorethyl ether were equally effective, and superior to oil alone in 1941 and 1942. All oil treatments caused appreciable tip stunting. A dust containing 33 per cent. cryolite, applied in 1943 at about 0·06 oz. per ear any time after the silk appeared, was as effective as oil with insecticide and caused no visible damage to the ears.

In 1944 and 1945, infestation was too light (less than 25 per cent.) for effective tests. A dust of 5 per cent. DDT in pyrophyllite applied to the ears caused no plant injury. It appears that under Nebraska conditions, *H. armigera* can be controlled on sweet maize by the treatment of individual ears with oil or oil and insecticide, but wide yearly and seasonal fluctuations in populations make it desirable to determine the extent of infestation and the correct time for treatment in order to obtain control and avoid injury to the ear, and this may be difficult. Also, the unfavourable growing conditions that often exist in Nebraska may cause irregular and prolonged silking, which necessitates additional trips through the field and encourages premature treatment, with resultant tip stunting.

WEHRLE (L. P.). **The Cucurbit Midge,** *Itonida citrulli*.—*J. econ. Ent.* **39** no. 3 pp. 415–416, 2 refs. Menasha, Wis., 1946.

Cecidomyia (*Itonida*) *citrulli*, Felt, which attacks water-melon (*Citrullus vulgaris*) in the Santa Cruz Valley of Arizona [*cf. R.A.E.*, A **23** 381 ; **29** 596], has apparently been there for many years. It is known only from that State, and its distribution appears to be limited to areas in which definite summer rains occur and in which irrigation is practised. It infests squash, pumpkin and wild and cultivated *C. vulgaris*, but was not found on the wild gourds, *Apodanthera undulata* and *Cucurbita digitata*. The larvae feed on the tips of terminal and side branches of watermelon and on the green buds or tips near the centre of squash, and reduce the production of fruit on both plants.

SIEGLER (E. H.) & GERTLER (S. I.). **The Toxicity of certain N-substituted Phenylhydrazines to Codling Moth Larvae.**—*J. econ. Ent.* **39** no. 3 pp. 416–417. Menasha, Wis., 1946.

A table is given showing the results of tests on larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., by the apple-plug method [*cf. R.A.E.*, A **23** 174] of 18 N-substituted phenylhydrazines, prepared by the reaction of phenylhydrazine with the required acid or acid chloride and used at concentrations of 4 lb. per 20 U.S. gals. ethyl alcohol (95 per cent.) and 80 U.S. gals. water. The compounds consisted mainly of phenylhydrazides of aliphatic acids, with some aromatic and sulphonic acids; 1-isovaleryl-2-phenylhydrazine proved slightly superior to lead arsenate and 1-acetyl-2-phenylhydrazine, 1-(m-nitrobenzoyl)-2-phenylhydrazine, 1-isobutyryl-2-phenylhydrazine and 1-phenyl-2-stearoylhydrazine relatively close to it in effectiveness.

FROST (S. W.). **Apple Fruit Worms in Pennsylvania.**—*J. econ. Ent.* **39** no. 3 p. 418, 2 refs. Menasha, Wis., 1946.

Of the Noctuid larvae known as green fruit worms, *Amphipyra pyramidoides*, Gn., is a much more important pest of apple in Pennsylvania than *Graptolitha antennata*, Wlk., or *G. grotei*, Ril., to which this common name is often applied. It feeds on the foliage more frequently than on the fruit, but sometimes does considerable damage to the latter. It is common throughout the eastern United States and has been reported from a number of trees. Larvae of *Conistra walkeri*, Grote, which have not apparently been recorded from fruit in the United States, though they are known to attack apples in Canada [*cf. R.A.E.*, A **7** 313], were collected repeatedly from apple and cherry in Pennsylvania. They are generally found in early spring feeding on the buds and unfolding leaves, pupate in June and transform to adults in the following spring. This species is common throughout eastern Canada and the United States from Maine to Iowa and south to Texas. *Morrisonia confusa*, Hb., which has previously been recorded only from willow, was also reared by the author from apple, an adult emerging in May from a pupa formed the previous September. It is apparently common throughout the eastern United States. A single adult of *Apatele* (*Apatela*) *interrupta* f. *elizabeta*, Smith, emerged from a pupa from apple, and *A.* (*A.*) *radcliffei*, Harvey, and *A.* (*A.*) *fragilis*, Gn., were reared from *Amelanchier*.

MARTIN (C. H.). **The Effect of Humidity on the Oviposition Activity of** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **39** no. 3 p. 419, 1 ref. Menasha, Wis., 1946.

In the mass-breeding of *Macrocentrus ancylivorus*, Rohw., on larvae of the potato tuber moth [*Gnorimoschema operculella*, Zell.] in potato, humidity may be the most important factor influencing the numbers produced, as it determines the oviposition activity of the parasite [*cf. R.A.E.*, A **34** 305]. When the relative humidity in the breeding trays varied between about 30 and 80 per cent., the parasites were very active at the highest humidity and could be observed probing for hosts, whereas they remained motionless at the lowest. When the humidity ranged from about 30 to 50 per cent., three times as many parasites were bred in trays with cloth-covered louvres as in those with 14-mesh, screen-covered louvres, because the former maintained more constant and higher humidities than the latter, in which humidity fluctuated with the room humidity. The temperature was 80°F. in all cases. These observations indicate that there may be a zone of humidity in which the numbers of *M. ancylivorus* bred decrease as the relative humidity decreases and that when humidity becomes sufficiently low during the daily fluctuations, oviposition and therefore the amount of parasitism may decrease.

(J. C.). **Insect Infestation in powdered Hand** 3 pp. 419–420. Menasha, Wis., 1946.

owder consisting of 40 per cent. soap and und to be due to the use of meal infested by meal is too coarse to be sifted to eliminate cts present in the milling machinery during t is fumigated, sterilised by heat or treated e. As a similar brand of soap, differing only f a light yellow steam-distilled pine oil, did s of 25 adults of *Tribolium confusum*, Duv., ch and without 4 per cent. pine oil, and these erature of 80°F. and 70–80 per cent. relative ays, all the beetles were alive, with numerous eggs ples without pine oil, whereas in the two samples containing it, 96 and 76 per cent. were dead after four days, and all after 16 and 30 days, respectively, and no reproduction took place. It is concluded that insect infestation in soap powder can be prevented by the addition of 4 per cent. pine oil ; lower percentages of oil were not tested.

SHAW (F. R.). **The Stalk Borer attacking Raspberries.**—*J. econ. Ent.* **39** no. 3 p. 425. Menasha, Wis., 1946.

Considerable injury to the twigs on the current season's canes of red raspberry, recently observed in a plot [probably in Massachusetts], was found to be due to larvae of *Papaipema nebris*, Gn. The injury was to the terminal 5–6 in. of the canes. The six larvae obtained varied in size, the largest being nearly fully grown and others only about ½ in. long.

HAGEN (K. S.). **The Occurrence of** *Ceutorhynchus assimilis* **(Paykull) in California.**—*Pan-Pacif. Ent.* **22** no. 2 p. 73, 1 ref. San Francisco, Calif., 1946.

The author reports that *Ceuthorrhynchus assimilis*, Payk., which is a common pest of cruciferous crops in Europe and was first reported from the United States in Washington in 1935 [*R.A.E.*, A **25** 85 ; *cf.* also **34** 76, etc.], was taken, on one occasion in large numbers, on the flower heads of *Brassica campestris* at three places in California in March and April 1946.

CALKINS (L. A.). **Notes on the Juniper Mealy Bug,** *Pseudococcus juniperi* **Ehrhorn.**—*J. Kans. ent. Soc.* **19** no. 2 pp. 66–69, 2 refs. Manhattan, Kans., 1946.

The author gives records of the occurrence in Kansas in 1941–45 of *Pseudococcus juniperi*, Ehrh., which has recently become a menace to juniper plantings in this State and parts of Oklahoma. It usually attacks the lower and inner branches first and then works upwards and outwards, causing browning and falling of the leaves and sometimes severe injury or the death of small trees 10–21 days after the attack is recognised. It was observed on a number of varieties of *Juniperus virginiana*, *J. communis*, *J. horizontalis*, *J. scopulorum* and *J. sabina*. All stages occurred in winter as well as in summer, and hatching appeared to continue throughout the year. The cold weather of late December and January seems to affect a large proportion of the adults, but populations are lowest after the spring rains of late March, April and early May. No wild trees have been found killed by the mealybug, possibly because of its control by parasites and predators. Natural enemies exerted some control in most urban infestations, though never enough to halt their spread or to prevent severe

damage to the trees. Parasites reared from the mealybug comprised *Tetrastichus minutus*, How., *Pachyneuron altiscuta*, How., and an undescribed species of *Anagyrus*, and at least one species of mite and larvae of a Coccinellid were observed preying on it. Two species of ants were found feeding on the honeydew, and several individuals carried nymphs down an infested tree after it had been sprayed. Flies are attracted to infested trees in large numbers and serve to indicate possible infestations.

Repeated application of a spray of nicotine sulphate and soap is stated to have given control on trees banded with an adhesive that kept away ants, but the author found that some trees were reinfested a few weeks after 4–5 applications had been made at intervals of 4–10 days. In preliminary tests with DDT, a water suspension containing 5 per cent. of a wettable powder (50 per cent. DDT) with the addition of about 12 cc. nicotine sulphate per U.S. gal. apparently gave complete kill within two weeks, and examination of another tree nearly two months after it had been sprayed with 5 per cent. DDT in a colloidal clay suspension with a small amount of wetting agent revealed no live mealybugs, flies or ants, though an unsprayed tree was heavily infested.

KNOWLTON (G. F.). **Grasshoppers eaten by Utah Birds.**—*J. Kans. ent. Soc.* **19** no. 2 pp. 71–72. Manhattan, Kans., 1946.

The author lists 56 kinds of birds caught in Utah in 1932–45 for examination of stomach contents, showing the number of each examined, the number containing grasshoppers and the number of grasshoppers in them. Of the 2,855 stomachs examined, 1,344 contained 7,024 grasshoppers.

KNOWLTON (G. F.). **European Earwig Control.**—[*Publ.*] *Utah agric. Coll. Ext. Serv.* N.S. 145, [4] pp., 2 figs., 1 ref. [Logan] Utah [1946].

The distribution of *Forficula auricularia*, L., in northern Utah and the damage it causes are briefly discussed [*cf. R.A.E.*, A **28** 631] and notes are given on its bionomics and control. Traps operated in 1939 to determine its seasonal abundance showed that its numbers were low during May and high from the beginning of June until late August, and it is recommended that control measures should be carried out during this period. A poison bait [**29** 538] scattered in the evening at the rate of 35 lb. per acre has given good control. Thorough applications should be made round trees, shrubs, telephone poles, wood piles, foundations of houses and other places frequented by the earwigs, preferably over a large area to prevent reinfestation, and repeated as often as necessary. Lawns should not be watered for two nights after the application of bait. Infested trees form important sources of reinfestation of buildings, and the trunks and larger branches may be sprayed with wettable DDT, or traps made of two grooved boards fitted together, dipped in DDT or sprayed with it, may be hung in the trees; the traps should be emptied at least once a week. DDT can also be used against earwigs in houses either as a dust or as a spray to leave a toxic deposit.

NESBITT (H. H. J.). **Three new Mites from Nova Scotian Apple Trees.**—*Canad. Ent.* **78** no. 1 pp. 15–22, 13 figs., 2 refs. Guelph, Ont., 1946.

The author describes the male and female of *Mediolata novae-scotiae*, sp. n., and the females of *Eupalus biscutum*, sp. n., and *Czenspinskia lordi*, sp. n., all from apple trees in Nova Scotia. *M. novae-scotiae* is commonly found on the underside of the leaves, feeds on the eggs of *Bryobia praetiosa*, Koch, and *Seiulus pomi*, Parrott, and probably on blister mites, and overwinters under oyster-shell scales [*Lepidosaphes ulmi*, L.] and pieces of bark. *E. biscutum* was found in the calyx end of apples, under bits of lichen and bark and at the base of apple leaves in the summer of 1945 and appeared to be predacious. *C. lordi*

Cotton (R. T.) & Frankenfeld (J. C.). **Insect Infestation in powdered Hand Soap.**—*J. econ. Ent.* **39** no. 3 pp. 419–420. Menasha, Wis., 1946.

Insect infestation in a soap powder consisting of 40 per cent. soap and 50–60 per cent. maize meal was found to be due to the use of meal infested by flour beetles [*Tribolium*]. Maize meal is too coarse to be sifted to eliminate eggs and small larvae, and insects present in the milling machinery during manufacture will infest it unless it is fumigated, sterilised by heat or treated in a centrifugal machine before use. As a similar brand of soap, differing only by the addition of 3–5 per cent. of a light yellow steam-distilled pine oil, did not appear to be infested, batches of 25 adults of *Tribolium confusum*, Duv., were added to samples of soap with and without 4 per cent. pine oil, and these were kept at a constant temperature of 80°F. and 70–80 per cent. relative humidity. At the end of 30 days, all the beetles were alive, with numerous eggs and larvae, in both the samples without pine oil, whereas in the two samples containing it, 96 and 76 per cent. were dead after four days, and all after 16 and 30 days, respectively, and no reproduction took place. It is concluded that insect infestation in soap powder can be prevented by the addition of 4 per cent. pine oil ; lower percentages of oil were not tested.

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has been taken at all seasons of the year from apple trees. It usually occurs in colonies on the leaves, and apparently overwinters beneath lichens and old oyster-shell scales. It feeds on vegetable matter, including the spores of apple scab [*Venturia inaequalis*]. It is thought to be parthenogenetic.

Sheppard (R. W.). **Occurrence of the Elm Leaf Beetle,** *Galerucella xanthomelaena* **(Schr.), at St. Catharines, Ontario.**—*Canad. Ent.* **78** no. 1 p. 22. Guelph., Ont., 1946.

On 11th July 1945, two elm trees (*Ulmus americana*) in the city of St. Catharines, Ontario, were found to be heavily infested with larvae of *Galerucella luteola*, Müll., (*xanthomelaena*, Schr.). Some of these were reared to adults by 25th July, and adults were abundant on the two trees and others in the vicinity on 30th July. W. J. Brown informed the author that this is the first authentic record for Canada, earlier reports [*cf. R.A.E.*, A **21** 541] being based on misidentifications of *Haltica* (*Altica*) *ulmi*, Woods.

Schechter (M. S.), Soloway (S. B.), Hayes (R. A.) & Haller (H. L.). **Colorimetric Determination of DDT. Color Test for related Compounds.**—*Industr. Engng Chem.* (Anal. Edn.) **17** pp. 704–709, 5 figs., 28 refs. Easton, Pa., 1945.

The following is partly based on the authors' summary. A colorimetric method, involving intensive nitration and the production of colours by the nitrated products in benzene with methanolic sodium methylate, is described for the estimation of small amounts of DDT (down to about ten micrograms). It can also be used to distinguish related compounds and degradation products such as dehydrochlorinated DDT, but in the case of technical DDT, if there is considerable decomposition, it might be difficult to interpret the results because of the complexity of the system. Care should also be taken when aromatic halogen compounds that might interfere are known to be present; however, such materials are unlikely to be present in spray residues.

Goodhue (L. D.) & Ballinger (W. R.). **Accelerated Aging Test for insecticidal Aerosols containing DDT.**—*Industr. Engng Chem.* (Anal. Edn.) **18** pp. 131–132, 1 fig., 4 refs. Easton, Pa., 1946.

The following is based on the authors' summary and the results of their tests. The introduction of DDT into the liquefied-gas aerosol has created the problem of stabilising the aerosol solution and preventing corrosion of the container. The ease with which hydrochloric acid is liberated from DDT in the presence of some iron salts has made necessary the development of an accelerated ageing test for studying the effect of the different aerosol constituents on this reaction. A simple pressure test tube and a method of running a test are described. The rate of decomposition varies greatly, depending mostly on the solvents used. Some of the combinations developed seemed to be satisfactory. A mixture of pyrethrum extract (20 per cent.), DDT, APS-202 (alkylated naphthalenes from petroleum) and Freon-12 (dichlordifluoromethane) was handled most easily and gave very good results; various proportions were tested and none broke down in less than 50 days and some have kept unchanged for more than 100 days. A mixture containing isophorone and lubricating oil (no. 30) instead of the alkylated naphthalenes was fairly stable, causing tar formation in 52 days, and the addition of 0·03 per cent. dioleyl malate to one of pyrethrum extract, DDT, cyclohexanone, lubricating oil and Freon-12 appeared to give added stability in some cases. Propylene oxide is an excellent solvent for DDT and a stabiliser, apparently owing to its ability to accept nascent hydrochloric acid, but is highly inflammable and slightly toxic. A mixture of pyrethrum extract, DDT, APS-202, propylene oxide and Freon-12 (2 : 3 : 7 : 5 : 83) appeared to

give the most stable DDT aerosol solution, no corrosion or tar formation occurring in tests running as long as 150 days ; this mixture was not inflammable. Freon-12 seemed to give a more stable solution than methyl chloride.

Fleck (E. E.) & Haller (H. L.). **Solubility of DDT in Kerosenes. Effect of auxiliary Solvents at subzero Temperatures.**—*Industr. Engng Chem.* **38** pp. 177–178, 4 refs. Easton, Pa., 1946.

The following is based on the authors' summary. The solubilities of technical and pure DDT in a number of kerosenes at temperatures ranging from —30 to 30°C. [—22 to 86°F.] were determined. It was found that kerosenes obtained from naphthenic-base crude oils dissolve more DDT than those obtained from paraffinic-base crude oils, the power of dissolving DDT generally increasing as the aniline point falls. The addition of petroleum fractions rich in alkylated naphthalenes retards the crystallisation of DDT from kerosene solution kept at —30°C.

Fleck (E. E.) & Haller (H. L.). **Stability of DDT and related Compounds.**—*J. Amer. chem. Soc.* **68** p. 142, 5 refs. Easton, Pa., 1946.

The authors consider that the apparently lower stability of DDT in the pure form than in the technical grade is due to the loss of impurities such as polymers of chloral and 2-trichlor-1-p-chlorphenylethanol that inhibit the action of catalytic agents in the latter. They describe experiments that indicate how readily small traces of catalytic material may be picked up in the course of air-drying and handling with iron or stainless-steel equipment and how this may lead to the assumption that DDT is not so stable in the pure form as in the crude state.

Campaña de exterminio de la plaga del zompopo, iniciada por el Departamento de Defensa Agrícola del Ministerio de Agricultura. [The Campaign to exterminate Leaf-cutting Ants, organised by the Department of Agricultural Defence of the Ministry of Agriculture.]—*Rev. agric. Guat.* **1** (1945) nos. 12–14 pp. 787–792, 7 figs. Guatemala [1946].

In view of the damage caused to plants by leaf-cutting ants [*Atta* spp.] in Guatemala and the failure of individual attempts at control, an official campaign for their extermination was inaugurated in October 1944. The method adopted was the introduction into the nest of the fumes produced by burning a mixture of arsenic and sulphur (1 : 4) with charcoal in a special combustion chamber attached to a pump [*cf. R.A.E.*, A **30** 424 ; **31** 479]. The method of using the apparatus is described. It is first placed over the main entrance of the nest and a mixture of oleaginous seeds and charcoal burnt in it. The smoke from this enables all the entrances to the nest to be located and stopped up, heats the galleries, thus preventing condensation of the vapours, and forms an oily deposit over ants, brood-chambers and fungus gardens, facilitating the toxic action of the vapours and preventing them from escaping into the soil.

Second and third applications are timed for the emergence of subsequent generations of the ants. Very good results were reported by persons employing this treatment.

Bosq (J. M.). **El " escarabajo negro del trigo " puede ser dañino a la silvicultura.** [*Dyscinetus gagates*, Burm., can be harmful to Silviculture.]—*Alm. Minist. Agric. Argent.* **20** pp. 65–67, 3 figs. Buenos Aires, 1945.

Adults of the Dynastid, *Dyscinetus gagates*, Burm., which is a pest of wheat in Argentina [*cf. R.A.E.*, A **30** 417], were observed causing considerable damage to seedlings of *Eucalyptus* and cypress [*Cupressus*] in plantations at Azul, in the Province of Buenos Aires. Up to ten beetles per plant occurred between

May and July on newly transplanted seedlings, and in one plantation, 11,000 one-year-old eucalyptus plants were totally destroyed. Older plants, transplanted later in the year, showed more resistance to attack. The parts injured were the roots and root collars.

VERGANI (A. R.). **Un ácaro dañino para el azafrán.** [A Mite damaging Saffron.] —*Alm. Minist. Agric. Argent.* **20** p. 156, 2 figs. Buenos Aires, 1945.

Saffron (*Crocus sativus*) in Argentina is frequently damaged by *Rhizoglyphus echinopus*, Fum. & Rob. (*hyacinthi*, Banks). The mites are briefly described, and immersion of the corms for ten minutes in water at 50°C. [122°F.] before planting is recommended for their control. Nicotine sulphate (1 : 400) may be added to the water for greater security [*cf. R.A.E.*, A **9** 241].

WILSON (F.) & MILLS (A. T.). **Surface Fumigation of Insect Infestations in Bulk-Wheat Depots.**—*Bull. Coun. sci. industr. Res. Aust.* no. 208, 31 pp., 1 pl., 3 graphs, 13 refs., multigraph. Melbourne, 1946.

Surface infestation by insects in wheat stored in bulk depots in Victoria [*R.A.E.*, A **34** 230] has been satisfactorily controlled by the combined use of mineral-dust barriers on the surface of the mounds [**35** 302] and local fumigation. This paper deals with investigations on fumigants for the latter purpose, in which the materials to be tested were applied directly to the surface of wheat containing natural insect populations, and the following is based on the authors' summary.

A practically complete kill of all stages of *Rhizopertha dominica*, F., and satisfactory control of the other species present [**34** 230] were given by carbon bisulphide at a dosage of 16 fl. oz. per sq. yd. wheat surface. Covering the surface with a gas-tight material for 24 hours after fumigation increased the mortality somewhat if a dosage of less than 16 fl. oz. was used. A mixture of ethylene dichloride and trichlorethylene (3 : 1) produced practically complete mortality in all stages of *Rhizopertha* when used at 45 fl. oz. per sq. yd., but the mortality in other insects was apparently below a desirable level. A mixture of ethylene dichloride and carbon tetrachloride (3 : 1) gave a very good kill of all stages of *Rhizopertha* and *Latheticus oryzae*, Waterh. Reports from the depots, however, suggest that these ethylene-dichloride mixtures give erratic results in commercial fumigation. Ethyl formate gave excellent control of *Rhizopertha* when used at 20 fl. oz. per sq. yd., or at 16 fl. oz. if the wheat was covered by a gas-tight material for 24 hours. These concentrations, however, do not give adequate control of *Latheticus* or, probably, of several other insects that are normally common but were not sufficiently abundant in these tests to give conclusive results.

After surface fumigation, there was an extremely rapid temperature fall in the superficial wheat layer to a level determined largely by the air temperature in the depot. Consequently, the amount and rate of this fall varied greatly according to the time of year. In winter, the temperature of the wheat near the surface fell rapidly to a level at which *Rhizopertha* could not reproduce. In summer, the decline in temperature was much less marked, but the loss of moisture to the atmosphere tended to make the environment unsuitable for the re-establishment of the infestation. At greater depths in the wheat, the rate of heat loss after fumigation was slow. There was no apparent tendency for the wheat to increase in moisture content on cooling, so that the lethal zone underlying infestation tended to remain unsuitable for reproduction after fumigation.

Surface fumigation has given good pest control in the depots, but fumigated areas were liable to re-infestation. This was probably attributable chiefly to under-estimation of the extent of the infested area, since each superficial infestation is surrounded by a marginal sub-surface infestation covered by cool wheat.

Strickland (A. G.). **Discovery of Queensland Fruit Fly** (*Chaetodacus tryoni*) **in Adelaide Suburbs.**—*J. Dep. Agric. S. Aust.* **50** no. 8 p. 404. Adelaide, 1947.

On 30th January and 3rd February 1947, larvae of the Queensland fruit-fly, *Dacus* (*Chaetodacus*) *ferrugineus tryoni*, Frogg., were found in two areas, covering approximately one half and one sq. mile, respectively, in the suburbs of Adelaide. No fruit-fly had previously been recorded in South Australia, and thorough investigation showed that the infestation was limited to these two areas. Within a few hours of the discovery of the larvae, all fruits known or thought to be infested were stripped from the trees or vines and either burned or dumped at sea in weighted bags, several miles from shore, and the fruits of all possible food-plants, including fruit-trees, vines and ornamental trees and plants situated within one mile of any recorded infestation, were subsequently also dumped at sea. Other measures undertaken within the one mile limit included the removal or poisoning of all boxthorn plants [*Lycium*], the treatment of all fruit-bearing kaffir apple plants [*Aberia kaffra*] with a strong DDT spray, the introduction of cochineal insects [*Dactylopius*] to destroy prickly pear [*Opuntia*] from which the fruits had been removed, the application of poison bait-sprays to all possible food-plants, and the distribution of bait-traps to eliminate any adults present and indicate the progress of the eradication campaign. The two areas within one mile of the recorded infestations were proclaimed at the outset, and a regulation was made prohibiting the removal of fruit from them or the cultivation in them of tomatos, peppers [*Capsicum*], egg-plant [*Solanum melongena*] and certain soft-skinned cucurbits during the period ending 31st October 1947.

It was anticipated that by mid-March all fruits on which eggs of *D. f. tryoni* could be deposited would have been eliminated, and that the removal of loquats [*Eriobotrya japonica*] and other later-setting fruits would ensure freedom from infestation throughout the winter. Other measures to be implemented in the proclaimed areas, at least until October 1947, were the maintenance of bait-sprays and traps and the application of DDT sprays to *Citrus* and other nectar-bearing trees during their next blooming.

Caldwell (N. E. H.). **Pin-hole Borers in deciduous Fruit Trees.**—*Qd agric. J.* **63** pt. 5 pp. 282–283. Brisbane, 1946.

The death of a number of deciduous fruit trees in the Granite Belt region of Queensland in 1944–46 is attributed to an unidentified Xyleborine beetle that had not previously been recorded from the area. The infestation was apparently not due to an unhealthy condition of the trees as some of them were among the best in the orchards concerned, and appeared to be quite up to the average standard of vigour for the district. They included at least seven varieties of apple, six of plum, three of peach, three of apricot and one each of cherry, nectarine and pear.

The adult beetles enter the trees by tunnelling through the bark and wood, usually in the trunk and lower portions of the main limbs. The small tunnels lead to irregular-shaped brood galleries, running mostly parallel with the grain, in which the eggs are laid ; the larvae feed on a fungus growing within galleries and pupate in them. Sap frequently exudes from the holes in the bark, particularly in the case of infested apple trees ; the foliage on one or more limbs may wilt, and the tree finally dies. Since the symptoms seem to be disproportionate to the mechanical damage, it is concluded that the beetle introduces a pathogenic fungus or bacterium, particularly as a pronounced internal discoloration of the wood occurs above and below each borer hole.

Sources of infestation should be reduced wherever possible by removing and burning immediately all dead and dying limbs or trees. Measures designed to prevent infestation, and to eliminate borers from trees already attacked, are being investigated.

HOGAN (T. W.) & SLAPE (H. W.). **Aerial Spraying for the Control of agricultural Pests in Victoria.**—*J. Dep. Agric. Vict.* **44** pt. 12 pp. 553–558, 562, 5 figs., 1 ref. Melbourne, 1946.

A spray containing 0·1 per cent. DDT as an emulsified solution applied to stone fruits by orchard spray pumps was found to give complete protection from infestation by *Nysius vinitor*, Bergr., for 2–3 weeks in Victoria, but since much damage might be caused before a grower could treat all his orchards in this manner, tests on the value of spraying from aircraft were begun in December 1945, when a serious outbreak of *N. vinitor* was in progress. A method of application devised for mosquito control in war areas was used in the initial tests. The spray consisted of 5 per cent. DDT and 0·2 per cent. pyrethrins in a mixture of equal parts of kerosene and fuel distillate and was contained in the auxiliary bomb-bay tank of a Beaufort Mark IX aircraft, from which it was released through a single vertical tube $2\frac{1}{2}$ ft. long and $4 \times 2\frac{1}{2}$ ins. in cross-section. A tank with a capacity of 138 gals. was employed for mosquito control, but for use against agricultural pests, the aeroplane was modified to carry 520 gals. spray solution. The latter was atomised as it left the tube by the force of the air-stream and was delivered at the rate of 5 pints per acre when the aeroplane was travelling at a speed of 150 miles per hour and an altitude of 100 ft. Atomisation was not sufficiently complete to give satisfactory results, however. An atomiser box with 2,400 holes, $\frac{1}{16}$ in. in diameter, in the front and side sections, which was welded to the bottom of the tube, was more effective, but still better results were given by a spray bar comprising two horizontal streamlined steel bars, 7 ft. long and 6 ins. apart, with a single row of holes $\frac{1}{8}$ in. in diameter at $\frac{1}{4}$ in. pitch drilled along the top. A spray containing 15 per cent. p,p′ DDT in a mixture of mineral turpentine and fuel distillate (2 : 1) applied with this equipment at a rate of 5 gals. per acre gave 93–94 per cent. mortality of *N. vinitor* exposed in cages in six hours except at one point. At this point, mortality was only 13 per cent., increasing to 74 per cent. after a further six hours, and similar irregularities, which are probably caused by localised air movements, were also observed in later tests. Continuous rain prevented any determination of residual effects and also terminated the outbreak.

Investigations were continued on *Chortoicetes terminifera*, Wlk. Since the double bar released the spray at a rate of only $1\frac{1}{2}$ gals. per second and had thereby necessitated two flights over the area to obtain the correct dosage, it was replaced by three streamlined bars, 11 ft. 10 ins. in length and 4 ins. in width, set 1 ft. apart and attached to two vertical steel tubes, $4\frac{1}{2}$ ins. in diameter, that conveyed the spray mixture to them. A spray of 5 per cent. benzene hexachloride (13 per cent. γ isomer) in a solvent carrier composed of 74 per cent. fuel distillate, 20 per cent. benzene and 6 per cent. lubricating oil applied at a rate of 4 gals. per acre over an area of 25 acres gave a mortality of 98 per cent. of the winged locusts within 30 hours. One of 4 per cent. benzene hexachloride in diesel fuel oil at a rate of $1\frac{1}{2}$ gals. per acre gave promising results in laboratory tests in which locusts at the bottom of a spray tower 20 ft. in height were exposed to a spray atomised at the top, and it was also found that solvent carriers of a volatility greater than or equal to that of kerosene are unsuitable for aerial spraying owing to wastage by evaporation. The solvent properties for the insecticides of most liquids of low volatility are poor, but since it was more economical to use a large volume of a less volatile solution with a low concentration of insecticide than to add a small amount of an efficient but expensive solvent to a more concentrated spray, the spray of benzene hexachloride and diesel fuel oil was tested in the field, where it gave excellent control of the adult locusts, but not more than 90 per cent. mortality of young hoppers. The spray bars were therefore further modified by drilling holes $\frac{1}{16}$ in. in diameter along the lower side of the upper and lower bars to produce smaller droplets. With this equipment, a rate of application of 4 gals. per acre

gave complete mortality over the greater part of the area, though control was poor in isolated patches and the full effect of the spray did not become apparent for 48 hours. In the test tower, dinitro-o-cresol and DDT (92 per cent. p, p′ isomer) gave results equivalent to those from benzene hexachloride, but these materials were not tested in the field, since the former injures crops when applied in oil and the latter is more costly and less toxic ; it may be of more value where a long residual effect is required, however.

In a discussion of the relation of droplet size to aerial spraying, it is pointed out that if the spray is correctly distributed as very fine particles and contains a high concentration of a potent insecticide, the lethal dose per acre can be carried in very small volumes, which enables the spray load to be kept light. The limitations to the maximum and minimum size of the droplets are discussed. A diameter of 50 μ is considered to be the lowest limit, since an oil particle of this diameter released at a height of 40 ft. in a wind travelling at a speed of 4 m.p.h. would travel almost 400 yards from the line of flight, which is the maximum drift permissible. If one gallon of liquid was evenly distributed over one acre in droplets 250μ in diameter, about 14 droplets would be deposited per sq. cm. With allowance for subdivision of some droplets and for wastage, the application of droplets of this maximum size appears to be adequate for large insects, but would necessitate a higher rate of application against small insects ; this could be achieved by reducing the concentration of the insecticide, but the effective load of the aircraft would then also be reduced. Wastage of spray is due to the presence of some particles larger than the optimum for the insect concerned and of some small enough to drift beyond the treated area, and data on the size of the particles produced during the field trials, obtained by placing glass slides coated with diglycol laurate in the path of the plane and dyeing the spray, showed that further wastage occurred with the apparatus finally adopted, owing to a tendency for the heaviest droplets to fall on the side of the swathe nearer to the path of the aircraft and the lightest on the far side. The droplets were not graded in accordance with their theoretical rates of fall, but a mixture of large and small ones were present at each point, probably owing to air turbulence. The largest droplets on the side of the swathe nearest to the plane were about 400μ in diameter and those on the far side of the swathe, 88 yds. distant, about 300μ ; no droplets with a diameter below 5μ were recovered. It was found that the droplets were smaller and the spray more evenly distributed when the speed of the aircraft was increased to 200 m.p.h. In most of the tests, the line of flight was at right angles to the wind, but effective control of the spray and slight concentration of dosage is possible by flying obliquely with or against it. When the flying speed is 180 m.p.h., the altitude of the aircraft should be 70 ft. when the air at ground level is calm, and 40–50 and 25–35 ft. with a wind at ground level of 6–10 and 10–20 m.p.h., respectively. The line of flight should be marked by two smoke generators, or, in large, open fields, by two flags.

Aeroplane Spraying of Locusts. Report on the Gunnedah Trial.—*Agric. Gaz. N.S.W.* **57** pt. 11 p. 577. Sydney, 1946.

The effectiveness of spraying from aircraft in controlling hoppers of the Australian plague locust [*Chortoicetes terminifera*, Wlk.] was tested in New South Wales over an extensive area of cultivated land with few trees. The hoppers were scattered more or less uniformly over the area and reached swarm density at three places. The sprays were distributed from a modified Beaufort bomber fitted with a boom consisting of three perforated bars [*cf.* preceding abstract] and travelling at 150 miles per hour at an altitude of 30–80 ft. The insecticides tested were benzene hexachloride and dinitro-o-cresol, both in diesel fuel oil, at concentrations of 4 and 2·7 per cent., respectively. Hoppers sprayed with benzene hexachloride were affected within an hour and some died in three hours ;

the day after the treatment, the number of living hoppers was considerably reduced, and there were many dead. Hoppers were still dying five days after the application. The crops treated were wheat, barley and oats that had made very little growth, and all were injured to some extent by the spray ; the wheat and barley had recovered in five days, however, and were growing well. Some of the hoppers treated with dinitro-o-cresol died within an hour. Mortality was very high along a band 20 yards wide, evidently owing to irregular settling of the spray. The stunted wheat that was sprayed with this material showed severe injury within three days. E. H. Graham stated that though this method is effective, the position of the swarms must be marked from the ground by means of smoke signals and it is difficult to deposit the spray accurately on isolated swarms without using excessive quantities ; the use of poison bait is, therefore, probably simpler and more convenient.

GOURLAY (E. S.). *Erechthias fulguritella* **Walk. (Lepidoptera) inhabiting Pine Cones.**—*N. Z. J. Sci. Tech.* **27** (B) no. 3 pp. 248–250, 2 figs., 4 refs. Wellington, N.Z., 1946.

Some of the pine cones found in late August and early September 1942 on trees that had been felled during the previous season and left intact on the ground in a plantation of *Pinus radiata* in the Nelson Province, New Zealand, were lighter in weight than normal ones and of a distinctive colour and contained frass indicative of larval feeding. Adults of *Erechthias fulguritella*, Wlk., emerged in November from some of a number that were kept in glass containers, together with a Bethylid parasite of the genus *Parasierola*, which probably attacks the larvae. The Tineid larvae feed within the cones, and invariably destroy the seeds. They pupate between the scales. Nearly all the light cones were infested by the fungus *Diplodia pinea*, but most of the seeds of those not also attacked by *E. fulguritella* were living. This moth, which has been recorded from several localities in New Zealand, is considered to be of negligible importance, owing to the small number of cones attacked. A description of the adult is quoted, and several colour variations described.

KELSEY (J. M.). **A Note on rearing** *Anobium punctatum* **De Geer.**—*N. Z. J. Sci. Tech.* **27** (B) no. 4 pp. 329–335, 5 figs., 1 ref. Wellington, N.Z., 1946.

The author describes a technique that was developed to induce *Anobium punctatum*, Deg., to oviposit on smooth wood surfaces, on which the eggs are easily counted [*cf. R.A.E.*, A **34** 211]. Smooth blocks of various sorts of wood that showed no eggs when examined microscopically were painted with a paste of flour and water and wrapped in fine-mesh organdie muslin, in some cases with cotton thread (no. 40) wound spirally round them first, and caged with males and females of *A. punctatum*. Under these conditions, females laid an average of 42·7 eggs each, of which 93·55 per cent. hatched ; 99·6 per cent. of the larvae tunnelled into the wood. There was no significant difference between the numbers of eggs laid on the blocks with muslin alone and on those with cotton threads under the muslin, but the latter were preferable as the eggs were dispersed over a wider area and not grouped in masses of 50–150, as on the former. It was found that the use of more than a single thickness of muslin was not advisable as there was considerable difficulty in counting eggs through two or three layers, and it is considered that replacing the muslin by a cellulose material with a mesh of the same size (approximately the size of the short diameter of *Anobium* eggs), but with the thread as thick as the length of the eggs, which would form small cells on the block and obviate the necessity for the cotton strands underneath, would be an improvement. Dyeing the material black or a contrasting colour would facilitate the counting of the white eggs.

Matthews (R. E. F.). **Sugar-beet Mosaic in New Zealand.**—*N. Z. J. Sci. Tech.* **27** (A) no. 4 pp. 294–302, 7 figs., 3 refs. Wellington, N.Z., 1946.

Leaves of sugar-beet and mangel exhibiting a mosaic mottling, the appearance of which is described, were received late in 1940 from a district in south-western North Island where infection was fairly general in a crop of sugar-beet grown for seed at one place and also occurred in mangels grown for seed in another. The disease was not transmitted through the seed of beet. It was readily transmitted by abrasion to mangel, three varieties of beet and three of spinach but not to solanaceous or cruciferous plants, by *Myzus persicae*, Sulz., from infected silver beet to healthy silver beet, red beet, sugar beet and mangel and by *Macrosiphum solanifolii*, Ashm., from infected to healthy silver beet ; both these aphids are common on beet. The symptoms experimentally produced in some of these plants and the physical properties of the virus are described and it is concluded that it is identical with *Beta* virus 2 of Smith [*Marmor betae* of Holmes], this constituting the first record of this virus from New Zealand. Transmission experiments in which 12 varieties of beet and mangel commonly grown in New Zealand were infected by *Myzus persicae* and another variety of silver beet was infected by abrasion, showed that none was resistant. Aphids are probably the most active agents in spreading the virus. In a field-plot test to determine its effect on yield, its spread from infected to healthy plants was so rapid, although Aphid infestation was light, that no estimate of the reduction could be made. It is probably carried over from one season to the next in biennial crops such as silver beet and perpetual spinach and in beet crops grown for seed.

Reid (W. D.). **Resistance of Beans to Halo-blight and Anthracnose and the Occurrence of Bean-mosaic and Bean-weevil.**—*N. Z. J. Sci. Tech.* **27** (A) no. 4 pp. 331–335, 1 fig., 1 ref. Wellington, N.Z., 1946.

Records of field infestation by the bean "weevil" [*Bruchus obtectus*, Say] on 72 varieties comprising 137 lines of dwarf and runner beans, made in New Zealand in 1944–45 in the course of two years' observations on their resistance to fungous diseases, suggested that there are wide differences in susceptibility to the Bruchid. White-seeded dwarf varieties and runner varieties showed little or no infestation and were also resistant to the fungi. Infection with bean mosaic [*Marmor phaseoli* of Holmes] occurred in some strains, mostly from recently imported seed, but had apparently died out in others.

Russo (G.). **I parassiti animali dannosi alle coltivazioni di cotone. Ricerche ed osservazioni eseguite in Italia nel 1941.** [Cotton Pests. Research and Observations made in Italy during 1941.]—*Ann. Fac. agrar. Pisa* (N.S.) **5** pp. 436–480, 1 pl. [lacking], 29 figs., 2 refs. Pisa, 1942. (With Summaries in English, French and German.)

Since insects cause the loss of some 30–50 per cent. of the cotton crop in Italy and Sicily, a survey of the species concerned was carried out by the author in 1941 as a basis for a control campaign. The results are presented in detail for each of the districts visited, supported in some cases by previous observations, and include information on local distribution, the nature and importance of the injury caused, and suggestions for control. The principal pests common to both Italy and Sicily were *Platyedra gossypiella*, Saund., *Heliothis armigera*, Hb., *Thrips tabaci*, Lind., *Bemisia tabaci*, Gennadius, Jassids of the genus *Empoasca* (mainly *E. decedens*, Paoli), *Agriotes lineatus*, L., *Laphygma* (*Caradrina*) *exigua*, Hb., *Aphis gossypii*, Glov. (*frangulae*, auct.), *Tetranychus telarius*, L., and woodlice (*Armadillidium* spp.). Pests found in Sicily only were *Earias insulana*, Boisd., *Pentodon punctatus*, Villers, *Agrotis segetum*, Schiff., and *Carpocoris*

pudicus, Poda (*purpureipennis*, Deg.). Other pests that occurred on the mainland were *Nezara viridula*, L., and *Dolycoris baccarum*, L., which punctured the immature bolls and sucked the seeds, and *Crocidosema plebeiana*, Zell., the larvae of which mined in the shoots and attacked the young bolls. Larvae of *Platyedra gossypiella* were parasitised by *Ephialtes* (*Pimpla*) *roborator*, F., and *Aphis gossypii* was attacked by *Coccinella septempunctata*, L., *Adalia bipunctata*, L., *Subcoccinella vigintiquatuorpunctata*, L., *Chrysopa carnea*, Steph., and *Xanthandrus comtus*, Harr.

GUILHON (J.). **Un nouveau parasitisme apiaire en France.**—*C.R. Acad. Agric. Fr.* **31** no. 11 pp. 548–550. Paris, 1945.

Records of Dipterous larvae parasitising honey bees in various parts of the world are briefly reviewed, and it is stated that parasitism of this type was not observed in France until 1928 and 1929, when larvae described by Séguy as *Myiapis angellozi* [*R.A.E.*, A **18** 365] were found in bees in the Rhône department. Larvae, apparently of this Tachinid, were observed in 1932 in the thoracic muscles and abdomen of several bees in Ardèche, and an unidentified Dipterous larva was found by Roubaud in a bee from a colony in the Vendée.

In July and August 1943, two Dipterous larvae, which are briefly described and are stated to resemble those of *M. angellozi*, were found in the thorax of two dead bees from Landes. Many bees in the colony from which they originated were unable to fly, and mortality in it was high, although neighbouring colonies remained healthy. The author suggests that parasitism of bees by Diptera may be more common in France than is supposed, and that it may account for certain symptoms, such as paralysis, the causes of which are at present unknown. It seems that, in France, larvae occurring in the thorax of bees can cause symptoms resembling those due to infestation by *Acarapis woodi*, Rennie, during the summer and should be looked for in feeble or unhealthy colonies exhibiting such symptoms.

In a statement following the paper, Roubaud suggests that the parasite found in 1943 is an Anthomyiid, whereas the one found by him in the Vendée was probably a Tachinid. He points out the need for distinguishing between parasitism that causes and that occurs subsequently to the death of bees.

RAUCOURT (M.) & VIEL (G.). **Propriétés insecticides de l'hexachlorocyclohexane.** —*C.R. Acad. Agric. Fr.* **31** no. 11 pp. 558–565, 3 refs. Paris, 1945.

The relative toxicity to insects of the α and β isomers of benzene hexachloride [*cf. R.A.E.*, A **33** 256] was investigated in France by tests on larvae of *Leptinotarsa decemlineata*, Say. They were separated by fractional crystallisation from technical benzene hexachloride, which contained about 70 per cent. α and about 3–4 per cent. β isomer, and were applied as dusts, either pure or diluted, to the larvae and the leaves of the food-plant. Each concentration was tested on a batch of ten larvae. The α isomer at concentrations of 50 and 100 per cent. caused feeding to cease almost immediately and killed five and four larvae in four days ; at 25 per cent., it also killed five, but feeding continued for 24 hours, and it was ineffective at 5 per cent. Larvae treated with the β isomer at concentrations of 25, 50 and 100 per cent. fed normally, and only one, which was dusted with the pure isomer, died in four days. Larvae dusted with 5 per cent. technical benzene hexachloride did not feed and were all dead in two days.

In further tests, technical benzene hexachloride was compared with DDT against both larvae and adults of *L. decemlineata*. Applied as dusts to larvae and leaves as before, DDT and benzene hexachloride gave complete mortality in three and five days, respectively, when used at a concentration of 1 per cent., and in two and four days at 1·5 per cent. All of ten adults fed on leaves dusted

with DDT and seven of ten on leaves dusted with benzene hexachloride, both at 5 per cent., were dead in 60 days, and the three that survived the latter treatment were moribund. In both tests, the beetles fed only during the first 24 hours. It was difficult to distinguish between contact and stomach action as the insects became coated with the dusts in moving about on the leaves. In the tests on fumigant action, made by confining the insects with the products so that they could not touch them, benzene hexachloride killed all of ten larvae in two days, as compared with three in five days for DDT, and all of ten adults in 60 days, as compared with none for DDT. The adults exposed to benzene hexachloride did not feed after the third day, while those exposed to DDT fed as freely as the controls.

BONNEMAISON (L.). **Sur l'action aphicide de quelques composés organiques.**—*C.R. Acad. Agric. Fr.* **32** no. 1 pp. 38–40. Paris, 1946.

Since abnormal weather in 1944 and 1945 and the scarcity of insecticides resulted in outbreaks of various Aphids in France, field and laboratory tests were carried out on the effectiveness against them of some newly-developed synthetic insecticides. In laboratory tests with sprays, the percentages of adults of the green apple aphis, *Aphis pomi*, Deg., and (in brackets) of the cabbage aphis *Brevicoryne brassicae*, L., killed were 95 (91) for 98 per cent. nicotine diluted to 0·2 per cent.; 50 (12) for 1 per cent. of a preparation containing 5 per cent. DDT; 91 (55) for a 1 per cent. suspension of one containing 10 per cent. technical benzene hexachloride; 86 (40) for 0·8 per cent. (1 per cent. in the case of *B. brassicae*) of an emulsion containing 5 per cent. technical benzene hexachloride; 89 (75) for 1 per cent. of a 10 per cent. solution of polychlorcyclane sulphide [*R.A.E.*, A **35** 313] in vegetable oil; 45 (23) for 3 per cent. of a 30 per cent. preparation of phenothiazine (thiodiphenylamine); 90 (73) for 1·5 per cent. of a white-oil emulsion containing 77 per cent. actual oil; 92 (69) for the same oil with the addition of 0·8 per cent. (1 per cent. in the case of *B. brassicae*) of 5 per cent. benzene hexachloride; and 78 (63) for 1 per cent. of a 20 per cent. preparation of dinitro-o-cresol. In addition, 0·2 per cent. of a preparation containing 10 per cent. dinitro-o-cyclohexylphenol gave 75 per cent. mortality of *A. pomi*, and 1 per cent. of an emulsible solution of 5 per cent. benzene hexachloride rich in the γ isomer gave 72 per cent. of *B. brassicae*. Dusts containing 5 per cent. DDT and 10 per cent. benzene hexachloride gave only 2·5 and 3·1 per cent. mortality of adults of *B. brassicae* at 27 lb. per acre, but most of the first- and second-instar nymphs treated with the latter fell from the plants and were generally unable to regain them.

In laboratory and field experiments in which the same materials were tested in sprays against *Eriosoma lanigerum*, Hsm., on apple, the percentages killed were 88 for the nicotine spray at 0·3 per cent.; 15 for 2 per cent. of the 5 per cent. preparation of DDT; 85 for 2 per cent. of the first preparation of benzene hexachloride; 80 for 2·5 per cent. of the second; 92 for 2 per cent. of the solution of benzene hexachloride rich in the γ isomer; 90 for 2 per cent. of the solution of polychlorcyclane sulphide; 22 for 8 per cent. of the preparation of phenothiazine; 94 and 80 for 3 and 2 per cent., respectively, of a white-oil emulsion containing 83 per cent. actual oil; 92 for 2 per cent. of the 5 per cent. technical benzene hexachloride in the same oil; and 12 for 2 per cent. of the preparation of dinitro-o-cresol. The effectiveness of benzene hexachloride and polychlorcyclane sulphide could probably be increased by the addition of oil or a strong wetting agent. It is pointed out that the experiments against *Eriosoma* were carried out on heavily infested shoots on which control is difficult, and that the spraying equipment employed gave only about one-quarter of the pressure necessary to remove the waxy secretion covering the Aphids and to penetrate the crevices in which they shelter.

Couturier (A.). **Une invasion de chenilles sur les bruyères dans les Landes.**—*C.R. Acad. Agric. Fr.* **32** no. 2 pp. 79–80. Paris, 1946.

Heather in the Landes department of France has for three years been seriously attacked by larvae of *Lasiocampa quercus*, L., probably owing to the exceptional climatic conditions. Infestation extended over an area of more than 380 square miles, and the bushes were entirely defoliated as early as April. The larvae fed first upon *Erica scoparia* and then *E. cinerea*; they did not attack *Calluna vulgaris*, though they fed readily on this and other plants in the laboratory. They are active by night, rest on the branches of the food-plant during the day and are most injurious in spring. They pupate in June in cocoons spun among the bushes, and the adults emerge in July. The females move little and oviposit on the bushes. The larvae hatch in a few days, feed for a little and then become immobile on the branches, where they overwinter. The damage to *E. scoparia* is unimportant, but *E. cinerea*, which is rich in nectar, is almost the sole source of honey in the area.

Direct control measures are impracticable over so large an area, but indications were obtained that the outbreak was being checked by natural enemies. Many dead, shrivelled larvae, evidently killed by disease, were found hanging from the ends of the branches, and at least 16 per cent. were parasitised by the Braconid, *Meteorus versicolor*, Wesm.

Trouvelot (B.) & Grison (P.). **Les variations des époques et intensités des infestations doryphoriques en France.**—*C.R. Acad. Agric. Fr.* **32** no. 4 pp. 149–152, 1 fig., 6 refs. Paris, 1946.

The results of comparative observations on the seasonal development of *Leptinotarsa decemlineata*, Say, in the different climatic regions of France are discussed, and the dates on which active oviposition by overwintered adults began in six regions in each of the years 1942–45 are shown in a graph. In general, they varied from year to year in each area, frequently by two or three weeks and sometimes by as much as a month. Active oviposition was first recorded each year in the south and became progressively later towards the north and north-east, but there was considerable variation from year to year in the interval between dates in different regions. The rate of larval development is closely regulated by climatic factors and also varies considerably according to the season and region. There appears to be some compensation between the accelerations and retardations in development due to changes in weather, especially as the season advances, and the dates of appearance of the later stages fluctuate less than those of the onset of active oviposition. At Versailles, the maximum differences between the dates of infestation on potatoes in spring, active oviposition and the appearance of first-generation adults over a period of four years were 14, 13 and five days, respectively. The exceptional summer droughts did not result in heavy infestation of potatoes, which confirms observations made in previous years, but infestation of egg-plant [*Solanum melongena*] became of importance. In 1945, warm weather early in spring caused early and heavy infestation, but larvae were subsequently of importance only in areas that did not experience abnormal spring drought. In many regions, active oviposition began very early, but was stopped by exceptional cold at the beginning of May, and except in certain regions in the south, only eggs deposited after this period gave rise to the main infestation by larvae.

Although it is possible in any region to forecast the dates of maximum oviposition and of infestation by larvae a little in advance by means of daily weather observations in spring, they cannot be determined from the date at which infestation begins in the earliest region, owing to the great influence exerted by local conditions. The biological and climatic surveys on which

local forecasts are based must be carried out each year, and comparative data on activities in other regions and in previous years are of value only in providing supplementary information.

D'Aguilar (J.) & Dommergues (P.). **Protubérances cellulaires dues à l'action de *Ceuthorrhynchus pleurostigma* Marsh. (Col. Curculionidae). (Note préliminaire.)**—*Bull. Soc. ent. Fr.* **51** no. 4 pp. 50–52, 1 pl., 4 refs. Paris, 1946.

During experiments in France in which pairs of *Ceuthorrhynchus pleurostigma*, Marsh., were placed on young cabbages under bell glasses, numerous small swellings appeared at the feeding punctures after 7–9 days. They separated the surrounding undamaged tissues and interfered with the functioning of the vascular bundles, and were produced by both hypertrophy and hyperplasia of the cells. In further tests, young cabbage plants under bell-glasses were infested with weevils of one sex or the other, pricked with a sterilised pin, or left untreated, and other young plants enclosed in muslin were infested with several pairs of weevils. The relative humidities under the bell-glasses and the muslin were 89 and 39 per cent., respectively. Swellings developed only on the infested plants under bell-glasses, and it is concluded that they are caused by a substance in the digestive juice, probably the saliva of adults of either sex under conditions of high and constant humidity. A cellular mass was noted on the plant under muslin at its base and near the soil, which was well watered, and similar swellings have been observed on cabbages sown under a frame.

When ovipositing, the female of *Ceuthorrhynchus* deposits an egg in a puncture made in the stem with the rostrum and immediately plugs the puncture with an anal secretion ; the characteristic gall develops in a few days. It is suggested that the plug isolates the salivary liquid and, by exluding the air from the puncture, enables a high degree of humidity to develop, thus favouring the development of a swelling.

Arnoux (J.) & Remaudière (G.). **Etude préliminaire sur *Acridomyia sacharovi* Stack. (Dipt. Muscidae) parasite en France de *Locusta migratoria* L.**—*Bull. Soc. ent. Fr.* **51** no. 4 pp. 53–62, 3 figs., 14 refs. Paris, 1946.

Some of the adults of *Locusta migratoria*, L., collected in the Gironde between 10th August and 15th October 1945, when an outbreak was in progress [*R.A.E.*, A **35** 377] contained larvae of *Acridomyia sacharovi*, Stackel., a parasite hitherto known only from the principal breeding sites of *L. migratoria migratoria* in the Aralo-Caspian basin [but *cf.* **23** 633]. The authors describe the last-instar larva, including characters indicating that the species may be represented by a separate race in France. The larvae were found chiefly in the abdomen of the host, and individual locusts contained 7–56, with an average of about 30. Larvae in the same host were all about the same size, and there appeared to be no correlation between their size and the number present. The 56 larvae found in one locust were in different stages of development, and this is attributed to overcrowding, not to oviposition by more than one female, a view supported by the small percentage of locusts parasitised. When fully grown, the larvae all left the host through a single hole and entered the soil where they pupated at a depth of 4–5 cm. within 24 hours. A few pupae formed in September or October gave rise to adults in the same year, but since adults were not observed in the field, though they were searched for between 1st September and 15th October, these emergences are thought to be unusual. Of 15 parasitised locusts collected, all were females. Parasitised locusts were generally found at the rear of a migrating band ; their vitality and power of flight appeared to be reduced, and the abdominal air-sacs were strongly atrophied. The presence

of the parasite did not appear to hinder the development of the ovaries, but the locusts did not oviposit, and died several hours after the parasites had left their bodies. Between 5th September and 7th November, parasitised locusts were found in seven districts in the Gironde, but the average rate of parasitism was only 1 per cent. Both the gregarious and the solitary phases were parasitised.

MÉQUIGNON (A.). *Apion trifolii* **L. ou** *Apion aestivum* **Germ.? (Col. Curculionidae).**—*Bull. Soc. ent. Fr.* **51** no. 4 pp. 62–63. Paris, 1946.

Opinions have long differed as to whether *Apion aestivum*, Germ., is or is not a synonym of *A.* (*Curculio*) *trifolii*, L. The view that it is not has been general since 1901, when Schilsky stated that *C. trifolii* could not be a species of *Apion* since Linnaeus described it as having a white abdomen. In 1845, however, Walton had stated that he had examined the Linnaean type and found that the abdomen was covered with white mould and was, in fact, black. The name *Apion trifolii* should therefore be applied to the species.

WILSON (G. F.). **Some Pests of deciduous ornamental Trees and Shrubs.**—*J. R. hort. Soc.* **71** pt. 7 pp. 193–202, 2 pls., 10 refs. London, 1946.

Lists are given of a number of Aphids, Coccids, moths and beetles that are pests of deciduous ornamental trees and shrubs in Great Britain, showing their food-plants and the types of damage they cause, and measures for their control are briefly reviewed.

BERAN (F.). **Methoden zur Prüfung von Pflanzenschutz- und Vorratsschutzmitteln XLI. Eine neue Methode zur Prüfung von Boden-Entseuchungsmitteln.** [Methods of testing Materials for protecting Plants and Stored Products. XLI. A new Method of testing Soil Disinfectants.]—*ReichsPflSchBl.* **2** no. 5 pp. 72–75, 2 figs., 4 refs. Berlin, 1944.

The effectiveness of a soil fumigant depends on its toxicity, which can be determined in an apparatus such as that of Peters & Ganter [*R.A.E.*, A **23** 258] and expressed as the product of concentration and time, and its ability to penetrate through the soil. Since no known method was satisfactory for determining the latter, an apparatus was devised for the purpose. It consists of a metal cylinder from which short metal tubes project at right-angles from holes perforated round the middle and in the base and removable top. The cylinder is filled with a known weight of finely sifted soil of a suitable moisture content, a quantity of the fumigant is inserted into the exact centre by means of a pipette, and at least ten individuals of a test insect are placed in each of the projecting tubes, which are then closed with rubber stoppers; records of mortality are kept, and fresh insects inserted after 24, 48 and 72 hours. For purposes of comparison, various types of soil, especially sand, clay and humus, should be tested. From the known toxicity of the fumigant and the time taken for mortality of the test insects, the concentration of fumigant in the tubes can be determined and hence its penetrative ability. A table is given showing the mortalities obtained when *Calandra granaria*, L., was exposed in the apparatus to the vapours of carbon bisulphide, carbon tetrachloride and Ventox [acrylonitrile], and the toxicities of these fumigants in air to the weevil and also to *Leptinotarsa decemlineata*, Say. Although carbon tetrachloride and carbon bisulphide are almost equally toxic to the weevil in air, the latter was far the more effective in soil and was also superior to Ventox, which, despite its high toxicity, had considerably less penetrative power. From the results obtained against one species, the effectiveness of a given soil fumigant against another species can be calculated, provided that its toxicity to the latter is known.

Beran (F.). **Die Resistenz des Kartoffelkäfers** (*Leptinotarsa decemlineata* **Say**) **gegen Begasungsmittel.** [The Resistance of *L. decemlineata* to Fumigants.] —*ReichsPflSchBl.* **2** no. 6 pp. 86–87. Berlin, 1944.

The results are given of tests to compare the resistance of young and overwintered adults of *Leptinotarsa decemlineata*, Say, to various fumigants that might be used in the soil for their control, and also the toxicity of the fumigants to *Calandra granaria*, L., *Tenebrio molitor*, L., and *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst. In each of the experiments, 4–20 individuals of *L. decemlineata*, 25 of *C. granaria* or 10 of *T. molitor* were exposed in a special apparatus [*cf. R.A.E.*, A **23** 258] and examined 24, 48 and 72 hours later ; the Coccid was exposed on twigs bearing at least 1,000 examples, which were examined three weeks after treatment. All concentrations are per 1,000 cu. ft. The results showed that hydrocyanic acid at 6·6 oz. killed all young adults of *L. decemlineata* and 20 per cent. of the old ones in 13·5 minutes : complete mortality of the old beetles required 45 minutes. Ventox [acrylonitrile] at 10 oz. gave complete mortality of young beetles in 24 minutes and of the old ones in 45 minutes. Tritox (trichloracetonitrile) at 20 oz. killed all young and old beetles in 1·5 and 3·75 hours, respectively, and the young beetles were also the more susceptible to a highly chlorinated organic compound (Bo 4091) and an organic flourine compound ("1908"). Carbon tetrachloride at 30 oz. gave only 50 per cent. mortality of young beetles in 8·33 hours, while all the older beetles were alive at the end of this time, and carbon bisulphide at 10 oz. required 25 hours to kill all the beetles. The greater resistance of the overwintered beetles is attributed to their lower rate of respiration immediately after hibernation. Although HCN, " 1908 " and Ventox all gave good results, the penetrative power of the first two in the soil is so limited, owing to absorption, that they cannot rank as efficient soil fumigants ; carbon bisulphide, however, despite its low toxicity, is of value owing to its exceptionally good penetrative power in most types of soil [see preceding abstract].

The toxicity of the various fumigants to the four insects tested, based on the mortality given at 20°C. [68°F.] and expressed as the product of concentration and time, is shown in a table. Some inconsistencies were apparent in comparative action. Thus, Ventox was far more effective against *C. granaria* than HCN, though the latter was the more effective against *L. decemlineata* ; HCN was far superior to " 1908 " against *Q. perniciosus*, but inferior to it against *C. granaria* and young adults of *L. decemlineata* ; and Tritox was inferior to Ventox against *C. granaria*, but superior to it against *Q. perniciosus*.

Emery (W. T.). **Temporary Immunity in Alfalfa ordinarily susceptible to Attack by the Pea Aphid.**—*J. agric. Res.* **73** no. 2 pp. 33–43, 5 figs., 15 refs. Washington, D.C., 1946.

The following is based on the author's introduction, summary and conclusions. Outbreaks of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on lucerne in the Middle West of the United States are sporadic, and it has been observed that individual plants known to be highly susceptible in the nursery in some seasons will not support an Aphid population in other seasons. Aphids put on such plants after they had been brought into the greenhouse in November failed to live on the stems developed in the field, but when the plants were cut back to permit new growth they became so heavily infested that they were quickly killed. This intermittent resistance of lucerne to *M. onobrychis*, referred to as temporary immunity, is associated with an acid condition in the plant. Experiments showed that this may be caused by a deficiency of water, a deficiency of light for photosynthesis, temperatures too low for rapid growth or temperatures sufficiently high to cause the formation of lignin. Tests for osazones in the cell sap of the plant and the gut of *M. onobrychis* showed that

the Aphids feed most in the elongating internodes, where growth is rapid and where sucrose is most abundant. Since the synthesis of protein is dependent on a carbohydrate-nitrogen ratio, it is considered that resistance of lucerne to *M. onobrychis* is correlated primarily with the acid condition and a scarcity or absence of sucrose, rather than with a scarcity of proteins in the plants.

BENNETT (C. W.) & MUNCK (C.). **Yellow Wilt of Sugar Beet in Argentina.**—*J. agric. Res.* **73** no. 2 pp. 45–64, 8 figs., 7 refs. Washington, D.C., 1946.

The authors describe the symptoms of a disease that they call yellow wilt, which has caused severe damage to sugar-beets in the valley of the Río Negro in Argentina, probably since the sugar-beet industry was first established in that region in 1929. One phase is characterised by stunting, yellowing of foliage, slight stimulation of development of axillary buds and leaf malformation, and another by wilting and rapid killing of the plants. The plants are not usually attacked until they attain a considerable size. Although the disease is most important in sugar-beet, limited evidence indicates that it may cause severe injury to red garden beets and spinach beet (Swiss chard), but an unidentified species of *Chenopodium* and *C. album*, both growing fairly abundantly in fields of diseased sugar-beet, and potatoes and tomatos in the vicinity of diseased beet plantings were not affected.

There is considerable evidence that yellow wilt is not transmitted through the soil or by direct contact between diseased and healthy plants. In the greenhouse, it was transmitted by grafting diseased to healthy tissue and by training stems of dodder (*Cuscuta*) from diseased to healthy plants, but not by juice inoculation. It was not transmitted by *Agalliana ensigera*, Oman, *Xerophloea viridis*, F., *Empoasca* sp., *Orthotylus* (*Melanotrichus*) sp. or *Myzus persicae*, Sulz., in field cage tests with insects swept from diseased beet, or by *M. persicae*, *Piesma cinerea*, Say, or *Eutettix tenellus*, Baker, in subsequent greenhouse experiments in Virginia, but it was transmitted in a field cage containing *Atanus exitiosus*, Beamer, together with additional contents of the net from sweeping infected beet, and it is considered almost certain that this Jassid is the vector. It is concluded that the disease is caused by a virus belonging, on the basis of its presumed vector and symptoms, to the genus *Chlorogenus* of Holmes, and the names *C. patagoniensis* and *Beta* virus 6 (following the classification of Smith) are suggested for it.

In January 1941, *A. exitiosus* was generally distributed throughout the region in which sugar-beet is grown in the valley of the Río Negro, but was not abundant in the beet fields. Females in field cages deposited eggs singly or in groups just under the surface of beet leaves, and the nymphs hatched in about 12 days and appeared to thrive on sugar-beet, though no nymphs were found on beet in the field. It thus appears that the leafhopper does not develop large populations on sugar-beet, possibly owing to a late migration into the fields and a low population of migrant adults. Despite this, it appeared to be more numerous on sugar-beet than on any other plant ; it was also taken on *Erodium cicutarium* and *Salsola kali*, but not on the two species of *Chenopodium* or two unidentified species of *Brassica* growing in or near the beet fields, on potato or tomato, or, except in a few instances close to beet fields, on desert vegetation of various kinds.

It was found that sugar-beet planted after the middle of December escaped yellow wilt to a considerable extent, but this date is later than that which gives maximum yields under disease-free conditions. It is not known whether the disease can be partly controlled by reducing the food-plants of the insect vector, but it is possible that spraying that caused considerable reduction of the vector would give beneficial results. Extensive tests with many European varieties of sugar-beet and two from the United States gave no evidence of an appreciable resistance in any variety.

Administration Report of the Director of Agriculture [British Guiana] **for 1944.**—26 pp. Georgetown, 1945.

A section of this report (pp. 18–20) deals with entomological work in British Guiana in 1944. A survey of the natural enemies of the Demerara sugar-cane froghopper, *Tomaspis flavilatera*, Urich, showed that the eggs are attacked by at least two species of parasites. They are undescribed Mymarids of the genus *Anagrus* and one or other was obtained from every batch of eggs examined; one of them gave significant control. The Cercopid was also attacked by the predacious larvae of *Salpingogaster nigra*, Schin. [*cf. R.A.E.*, A **7** 139], but this Syrphid was not highly effective, possibly because the larvae cannot migrate from stool to stool [*cf.* **21** 519]. Two puparia of *S. nigra* parasitised by *Aphidencyrtus* were found, but the parasites did not appear to be prevalent enough to limit its increase. Nymphs of the froghoppers infected by a fungus were collected, but though this was apparently *Metarrhizium anisopliae*, which controls *T. saccharina*, Dist., in Trinidad under conditions of high humidity [*cf.* **21** 520], it did not produce typical spores. Infected adults were therefore introduced from Trinidad in October 1944.

In detailed tests of DDT against *Calandra oryzae*, L., in stored rice, a dosage of one part to 50,000 parts rice destroyed all the test insects in 72 hours.

Risbec (J.). **Sur quelques charançons des cucurbitacées au Sénégal.**—*Agron. trop.* **1** no. 5–6 pp. 290–295, 9 figs. Nogent-sur-Marne, 1946.

The author gives short descriptions of the larva, pupa and adult of *Cryptobathys setarius*, Thoms., and of the adults of *Osphilia ikuthana*, Heller, var. *innotata*, Heller, and *Phloeophagosoma cucurbitae*, Mshl., three weevils found damaging cucurbits in Senegal. The larvae of *Cryptobathys* bore in the twigs of *Cucurbita maxima*, weakening the plants, and pupate in their tunnels; the adults feed on the leaves. A Cleonymid of a genus resembling *Zapachia* was reared from a pupa and a Eupelmid of the genus *Eutrichosoma* was found beside the cast skin of a larva, which it had almost certainly parasitised. The adults of these are described. Six species of Histerids, one of which is thought to be *Carcinops quatuordecimstriata*, Steph., were found in the galleries. The larvae of *Osphilia* live and pupate in the bark of the baobab [*Adansonia digitata*], apparently without causing much injury to the tree, and transform to adults in April and May. The adults feed on the leaves of native watermelons. Both these weevils were common in April 1945, though they had hitherto been unimportant. The adults of *P. cucurbitae* were found feeding on the seeds of watermelon, having penetrated the fruits, but injury was not widespread.

Mimeur (J. M.). **Aleurodidae du Maroc (1re note).**—*Bull. Soc. Sci. nat. Maroc* **24** (1944) pp. 87–89, 1 ref. Rabat, 1946. *Neomaskellia bergii* **Signoret (Hemiptère-Aleurodidae) en A.O.F.**—*T.c.* p. 89.

In the first of these papers, the author records three Aleurodids from Morocco. *Trialeurodes vaporariorum*, Westw., was frequently found in the regions of Rabat and Casablanca from February to December on the underside of the leaves of the introduced plant, *Lantana camara*. *Bemisia tabaci*, Gennadius, was found on various plants, including cotton, olive, pear, pomegranate and *L. camara*, and was active near Rabat from February to November. The larvae and pupae were parasitised by *Encarsia partenopea*, Masi, and attacked by the larvae of three species of *Chrysopa* and a Coccinellid. *Siphoninus phillyreae*, Hal., was numerous in some years on the leaves of *Crataegus oxyacantha monogyna*; it was active from May to November in the plains and from July to October in the hills. It is stated that a large proportion of the larvae and pupae were sometimes parasitised by an undetermined species of *Aphidius* in the autumn.

In the second paper, it is reported that *Neomaskellia bergii*, Sign., was found on sorghum in parts of French West Africa.

PAPERS NOTICED BY TITLE ONLY.

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TELFORD (H. S.) & GUTHRIE (J. E.). **Effects of oral Dosages of DDT on certain Vertebrates** [fowls, goats and a horse].—*J. econ. Ent.* **39** no. 3 pp. 413–414, 2 refs. Menasha, Wis., 1946. [See *R.A.E.*, B **35** 192.]

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